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Office of Environmental Sustainability
Environmental Protection Agency
PO Box 3000
Johnstown Castle Estate
Co. Wexford

257501.0094TN02 Air Quality RFI

RE: EPA Industrial Emissions Licensing Application P1186-02

Dear Sir/Madam,

On behalf of the applicant, Amazon Data Services Ireland Limited, and further information requested 21 January 2025 by the EPA, we submit further information and clarifications related to Air Quality (Response to Items 1 through 9 related to the Air Quality Impact Assessment, and BAT Response Item 2(c)) in respect of the licence application P1186-02.

Request 1.(a) and 1.(b)

1. It is stated that "The closest sensitive ecological area is the Santry Demesne Proposed NHA (000178) which is located within 1 km south-west of the subject site. Dispersion modelling of NO_X emissions from the installation has been conducted within the Santry Demesne pNHA to determine the potential impact to vegetation as a result of emissions from the back-up generators on site."
    a. Confirm that the assessment was not only performed for Santry Demesne pNHA and that the assessment included all other relevant ecological receptors.
    b. Provide the results of the assessments for both the closest ecological receptor and the ecological receptor which modelling shows may have the potential to be most impacted (noting these may or may not be the same ecological receptor).

Response To 1.(a) and 1.(b)

The impact of emissions of NO_X, SO_2, NH_3 and nutrient and acid deposition within 20 km of the facility on ambient ground level concentrations within the following designated habitat sites was assessed using AERMOD. The 20 km distance was selected based on maximum extent of the impact zone from the air emissions onsite. After 20 km, the ambient air concentration of NO_X, SO_2, NH_3 and nutrient and acid deposition due to emissions from the facility are imperceptible.

The designated habitat sites within 20 km of the site are shown below:

- **Proposed Natural Heritage Areas (pNHA)** – Ballybetagh Bog pNHA, Booterstown Marsh pNHA, Dingle Glen pNHA, Dodder Valley pNHA, Dolphins, Dublin Docks pNHA, Donadea Wood pNHA, Fitzsimon's Wood pNHA, Glenasmole Valley pNHA, Glencree Valley pNHA, Grand Canal pNHA, Kilteel Wood pNHA, Knocksink Wood pNHA, Liffey At Osberstown pNHA, Liffey Valley pNHA, Lugmore Glen pNHA, North Dublin Bay pNHA, Poulaphouca Reservoir pNHA, Red Bog, Kildare pNHA, Royal Canal pNHA, Rye Water

Valley/Carton pNHA, Santry Demesne pNHA, Slade Of Saggart And Crooksling Glen pNHA, South Dublin Bay pNHA;

- **Special Areas of Conservation (SAC) / Special Protection Area for Birds (SPA) –** Glenasmole Valley SAC, Knocksink Wood SAC, Baldoyle Bay SAC/SPA, North Dublin Bay SAC/SPA, North Bull Island SPA, Red Bog, Kildare SAC, North-West Irish Sea SPA, Rye Water Valley/Carton SAC, South Dublin Bay SAC/SPA and Wicklow Mountains SAC

An annual limit value of 30 µg/m^3 for NO_X and 20 µg/m^3 for SO_2 is specified within EU Directive 2008/50/EC for the protection of ecosystems. The NO_X limit value is applicable only in highly rural areas away from major sources of NO_X such as large conurbations, factories and high road vehicle activity such as a dual carriageway or motorway. Annex III of EU Directive 2008/50/EC identifies that monitoring to demonstrate compliance with the NO_X limit value for the protection of vegetation should be carried out distances greater than:

- 5 km from the nearest motorway or dual carriageway;
- 5 km from the nearest major industrial installation;
- 20 km from a major urban conurbation.

There are sections of designated sites which are near the facility that are close to industrial facilities, the M50/M1 motorway and Dublin City, so the limit value for NO_X and SO_2 for the protection of ecosystems is not technically applicable at these sites. Regardless, the annual average concentrations for NO_X and SO_2 from all emission points at the facility were predicted at receptors within the designated sites for all five years of meteorological data modelled (2018 – 2022). With receptor spacing of 500 m, 1,777 discrete receptors were modelled in total within the sensitive ecosystems.

The closest ecological habitat site to the facility is the Santry Demense pNHA, which is approx. 1.3 km to the west of the facility. The closest Natura 2000 designated habitat, to the facility is the South Dublin Bay & Tolka Estuary SPA at 4.0km to the south of the facility with the most impacted Natura 2000 site being the Baldoyle Bay SAC (site code 000199), which is approx. 4.5 km to the east of the facility.

In order to consider the effects of nitrogen and acid deposition owing to emissions from the facility on the designated habitat sites, the maximum annual mean NO_2, NH_3 and SO_2 predicted environmental concentrations must be converted firstly into a dry deposition flux using the equation below which is taken from UK Environment Agency publication "AGTAG06 – Technical Guidance On Detailed Modelling Approach For An Appropriate Assessment For Emissions To Air"[(1)]:

Dry deposition flux (µg/m^2/s) = ground-level concentration (µg/m^3) x deposition velocity (m/s)

The deposition velocities for NO_2, NH_3 and SO_2 are outlined in AQTAG06 and shown below in Table 1. The dry deposition flux is then multiplied by conversion factors shown in Table 1 (taken from AQTAG06) to convert it to a nitrogen (N) and sulphur (S) deposition flux (kg/ha/yr), and to an acid deposition flux (keq/ha/yr).

Table 1. Dry Deposition Fluxes for NO_2, NH_3 and SO_2

Chemical Species	Habitat Type	Recommended Deposition Velocity (m/s)	Nitrogen Deposition Conversion factor µg/m^2/s to kg/ha/yr	Avid Deposition Conversion factor µg/m^2/s to keq/ha/yr
NO_2	Grassland	0.0015	95.9	6.84
NH_3	Grassland	0.02	260	18.5
SO_2	Grassland	0.012	157.7	9.84

Background concentrations for NO_X, SO_2, and nitrogen and acid deposition at the most impacted modelled designated habitats were derived from the 1 km grid square concentrations provided on the Air Pollution Information System (APIS) website[2], in line with UKEA[3] and UK Defra[4] guidance, and are shown in Table 2. The background concentrations are added directly to the modelled process contributions to give a total predicted environmental concentration.

Table 2. Dry Deposition Fluxes for NO_2, NH_3 and SO_2

Closest Sensitive Designated Habitat	NO_x ($\mu g/m^3$)	NH_3 ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)	Nitrogen Deposition (kg/ha/yr)	Acid Deposition (keq/ha/yr)
Santry Demense pNHA	17.1	1.5	1.8	7.0	0.5
Baldoyle Bay SAC	10.9	1.5	1.8	6.0	0.5
South Dublin Bay & Tolka Estuary SPA	29.79	1.27	7.4	6.8	0.59

Sensitive Ecological Habitats

The ecological habitat site most impacted by the facility, and where the highest modelled concentrations are predicted, is the Santry Demense pNHA while the most impacted Natura 2000 designated habitat site is the Baldoyle Bay SAC.

Ecological Impact

NO_X

The NO_X modelling results are detailed in Table 3. Within the most impacted ecological habitat site (Santry Demense pNHA), at the worst-case location, emissions from the facility lead to an ambient NOX concentration (including background) which is at most 58% of the annual limit value over the five years of meteorological data modelled.

Within the most impacted Natura 2000 designated habitat (Baldoyle Bay SAC), at the worst-case location, emissions from the facility lead to an ambient NO_X concentration (including background) which is at most 37% of the annual limit value over the five years of meteorological data modelled.

Table 3. NO_X Dispersion Model Results

Pollutant / Year	Designated Habitat	Annual Mean Process Contribution ($\mu g/m^3$)	Annual Mean Back-ground ($\mu g/m^3$)	Annual Mean Predicted Environmental Concentration ($\mu g/m^3$)	Limit Value ($\mu g/m^3$)	PEC % of Limit Value
NO_X / 2018	Santry Demense pNHA	0.38	17.10	17.48	30	58%
	Baldoyle Bay SAC	0.26	10.90	11.16		37%
NO_X / 2019	Santry Demense pNHA	0.43	17.10	17.53	30	58%
	Baldoyle Bay SAC	0.27	10.90	11.17		37%
NO_X / 2020	Santry Demense pNHA	0.33	17.10	17.43	30	58%
	Baldoyle Bay SAC	0.27	10.90	11.17		37%
NO_X / 2021	Santry Demense pNHA	0.43	17.10	17.53	30	58%
	Baldoyle Bay SAC	0.26	10.90	11.16		37%
NO_X / 2022	Santry Demense pNHA	0.38	17.10	17.48	30	58%
	Baldoyle Bay SAC	0.26	10.90	11.16		37%

NH_3

The NH_3 modelling results are detailed in Table 4. Within the most impacted ecological habitat site (Santry Demense pNHA), at the worst-case location, emissions from the facility lead to an ambient NH_3 concentration (including background) which is at most 50% of the annual limit value over the five years of meteorological data modelled.

Within the most impacted Natura 2000 designated habitat (Baldoyle Bay SAC), at the worst-case location, emissions from the facility lead to an ambient NH_3 concentration (including background) which is at most 50% of the annual limit value over the five years of meteorological data modelled.

Table 4. NH_3 Dispersion Model Results

Pollutant / Year	Designated Habitat	Annual Mean Process Contribution (µg/m³)	Annual Mean Back-ground (µg/m³)	Annual Mean Predicted Environmental Concentration (µg/m³)	Limit Value (µg/m³)	PEC % of Limit Value
NH_3 / 2018	Santry Demense pNHA	0.00088	1.5	1.50088	3.0	50%
	Baldoyle Bay SAC	0.00055	1.5	1.50055		50%
NH_3 / 2019	Santry Demense pNHA	0.0011	1.5	1.5011	3.0	50%
	Baldoyle Bay SAC	0.00055	1.5	1.50055		50%
NH_3 / 2020	Santry Demense pNHA	0.00066	1.5	1.50066	3.0	50%
	Baldoyle Bay SAC	0.00055	1.5	1.50055		50%
NH_3 / 2021	Santry Demense pNHA	0.00099	1.5	1.50099	3.0	50%
	Baldoyle Bay SAC	0.00044	1.5	1.50044		50%
NH_3 / 2022	Santry Demense pNHA	0.00088	1.5	1.50088	3.0	50%
	Baldoyle Bay SAC	0.00044	1.5	1.50044		50%

SO_2

The SO_2 modelling results are detailed in Table 5. Within the most impacted ecological habitat site (Santry Demense pNHA), at the worst-case location, emissions from the facility lead to an ambient SO_2 concentration (including background) which is at most 9.1% of the annual limit value over the five years of meteorological data modelled.

Within the most impacted Natura 2000 designated habitat (Baldoyle Bay SAC), at the worst-case location, emissions from the facility lead to an ambient SO_2 concentration (including background) which is at most 9.0% of the annual limit value over the five years of meteorological data modelled.

Table 5. SO_2 Dispersion Model Results

Pollutant / Year	Designated Habitat	Annual Mean Process Contribution (µg/m³)	Annual Mean Back-ground (µg/m³)	Annual Mean Predicted Environmental Concentration (µg/m³)	Limit Value (µg/m³)	PEC % of Limit Value
SO_2 / 2018	Santry Demense pNHA	0.010	1.800	1.810	20.0	9.0%
	Baldoyle Bay SAC	0.007	1.800	1.807		9.0%
SO_2 / 2019	Santry Demense pNHA	0.011	1.800	1.811	20.0	9.1%

Pollutant / Year	Designated Habitat	Annual Mean Process Contribution (µg/m³)	Annual Mean Back-ground (µg/m³)	Annual Mean Predicted Environmental Concentration (µg/m³)	Limit Value (µg/m³)	PEC % of Limit Value
	Baldoyle Bay SAC	0.007	1.800	1.807		9.0%
SO_2 / 2020	Santry Demense pNHA	0.009	1.800	1.809	20.0	9.0%
	Baldoyle Bay SAC	0.007	1.800	1.807		9.0%
SO_2 / 2021	Santry Demense pNHA	0.011	1.800	1.811	20.0	9.1%
	Baldoyle Bay SAC	0.007	1.800	1.807		9.0%
SO_2 / 2022	Santry Demense pNHA	0.010	1.800	1.810	20.0	9.0%
	Baldoyle Bay SAC	0.007	1.800	1.807		9.0%

Nitrogen Deposition

In order to consider the effects of nitrogen deposition (as N) owing to emissions from the facility on the sensitive ecological habitat sites, the maximum annual mean NO_2 and NH_3 process contribution concentrations (PC) are converted into the dry deposition fluxes and then nitrogen deposition fluxes and shown in Table 6.

The nitrogen deposition flux for the worst-case year is 7.061 kg/ha/yr, shown in Table 6, and is below the range in worst-case critical loads of 10-15 kg/ha/yr[(2)] for the habitat types (hedgerow, tall herbs, calcareous grassland, reed fringe, open water, scrub and woodland) in the Santry Demense pNHA, indicating that the effects of nitrogen deposition on ecological habitat sites due to the facility are not significant.

Within the most impacted Natura 2000 designated habitat (Baldoyle Bay SAC), at the worst-case location, the nitrogen deposition flux for the worst-case year is 6.038 kg/ha/yr, shown in Table 6. This is within the range in worst-case critical loads of 5-10 kg/ha/yr[(2)] for the "Atlantic salt meadows (Glauco-Puccinellietalia maritimae)", indicating that the effects of nitrogen deposition on designated sites due to the facility are not significant.

Table 1. Normal Operations – Nitrogen Deposition

Met. Year	Designated Habitat	NO_2 Annual Mean PC ($\mu g/m^3$)	NH_3 Annual Mean PC ($\mu g/m^3$)	NO_2 Dry Deposition ($\mu g/m^2/s$)	NH_3 Dry Deposition ($\mu g/m^2/s$)	NO_2 Acid Deposition (keq/ha/year)	NH_3 Acid Deposition (keq/ha/year)	APIS Background Nitrogen Deposition (kg/ha/yr)	Total (NO_2 + NH_3) PEC Nitrogen Deposition kg/ha/yr
2018	Santry Demesne pNHA	0.34	0.0009	0.0005	0.00002	0.048	0.005	7.0	7.053
	Baldoyle Bay SAC	0.23	0.0005	0.0003	0.00001	0.033	0.003	6.0	6.036
2019	Santry Demesne pNHA	0.38	0.0011	0.0006	0.00002	0.055	0.005	7.0	7.061
	Baldoyle Bay SAC	0.24	0.0005	0.0004	0.00001	0.035	0.003	6.0	6.038
2020	Santry Demesne pNHA	0.30	0.0006	0.0004	0.00001	0.043	0.003	7.0	7.046
	Baldoyle Bay SAC	0.24	0.0005	0.0004	0.00001	0.035	0.003	6.0	6.038
2021	Santry Demesne pNHA	0.39	0.0009	0.0006	0.00002	0.056	0.005	7.0	7.061
	Baldoyle Bay SAC	0.23	0.0005	0.0003	0.00001	0.033	0.002	6.0	6.036
2022	Santry Demesne pNHA	0.34	0.0009	0.0005	0.00002	0.049	0.005	7.0	7.053
	Baldoyle Bay SAC	0.23	0.0005	0.0003	0.00001	0.033	0.003	6.0	6.036

Acid Deposition

In order to consider the effects of acid deposition (as N) owing to emissions from the facility on the most impacted ecological habitat site, the maximum annual mean NO_2 process contribution concentrations (PC) are converted into the dry deposition fluxes and then acid deposition fluxes and shown in Table 7 and Table 8.

Within the most impacted ecological habitat site (Santry Demense pNHA), at the worst-case location, the total acid deposition (as N) flux for the worst-case year is 0.506 keq/ha/yr, shown in Table 7 and Table 8.

This is below the worst case maximum critical load range of 0.714 – 5.146 keq/ha/yr for the habitats (hedgerow, tall herbs, calcareous grassland, reed fringe, open water, scrub and woodland) in the Santry Demense pNHA, indicating that the effects of acid deposition (as N) on ecological habitat sites due to the facility are not significant.

Within the most impacted Natura 2000 designated habitat (Baldoyle Bay SAC), at the worst-case location, the total acid deposition (as N) flux for the worst-case year is 0.504 keq/ha/yr, shown in Table 7 and Table 8.

This is below the worst case maximum critical load range of 0.714 – 5.007 keq/ha/yr for the "Fixed coastal dunes with herbaceous vegetation (grey dunes)", indicating that the effects of acid deposition (as N) on designated sites due to the facility are not significant.

Table 7. Acid Deposition (as N) at Most Impacted Ecological Habitat Sites – Normal Operations

Met. Year	Designated Habitat	NO_2 Annual Mean PC ($\mu g/m^3$)	NH_3 Annual Mean PC ($\mu g/m^3$)	NO_2 Dry Deposition ($\mu g/m^2/s$)	NH_3 Dry Deposition ($\mu g/m^2/s$)	NO_2 Acid Deposition (keq/ha/year)	NH_3 Acid Deposition (keq/ha/year)	Total (NO_2 + NH_3) PC Acid Deposition (as N) keq/ha/yr)
2018	Santry Demesne pNHA	0.335	0.0009	0.0005	0.000018	0.003	0.0003	0.004

Met. Year	Designated Habitat	NO_2 Annual Mean PC ($\mu g/m^3$)	NH_3 Annual Mean PC ($\mu g/m^3$)	NO_2 Dry Deposition ($\mu g/m^2/s$)	NH_3 Dry Deposition ($\mu g/m^2/s$)	NO_2 Acid Deposition (keq/ha/year)	NH_3 Acid Deposition (keq/ha/year)	Total (NO_2 + NH_3) PC Acid Deposition (as N) keq/ha/yr)
	Baldoyle Bay SAC	0.231	0.0005	0.0003	0.000011	0.002	0.0002	0.003
2019	Santry Demesne pNHA	0.383	0.0011	0.0006	0.000021	0.004	0.0004	0.004
	Baldoyle Bay SAC	0.244	0.0005	0.0004	0.000011	0.003	0.0002	0.003
2020	Santry Demesne pNHA	0.299	0.0006	0.0004	0.000012	0.003	0.0002	0.003
	Baldoyle Bay SAC	0.245	0.0005	0.0004	0.000010	0.003	0.0002	0.003
2021	Santry Demesne pNHA	0.388	0.0009	0.0006	0.000019	0.004	0.0003	0.004
	Baldoyle Bay SAC	0.231	0.0005	0.0003	0.000009	0.002	0.0002	0.003
2022	Santry Demesne pNHA	0.339	0.0009	0.0005	0.000017	0.003	0.0003	0.004
	Baldoyle Bay SAC	0.231	0.0005	0.0003	0.000010	0.002	0.0002	0.003

Table 8. Normal Operations – Acid Deposition (as S)

Year	Designated Habitat	SO_2 Annual Mean PEC ($\mu g/m^3$)	SO_2 Dry Deposition ($\mu g/m^2/s$)	SO_2 Sulphur Deposition (kg/ha/year)	SO_2 Acid Deposition (as S) (keq/ha/year)	APIS Background Acid Deposition (keq/ha/yr)	Total (NO_2 + NH_3 +SO_2) PEC Acid Deposition (keq/ha/yr)
2018	Santry Demesne pNHA	0.0096	0.0001	0.0182	0.0011	0.500	0.505
	Baldoyle Bay SAC	0.0067	0.0001	0.0126	0.0008	0.500	0.503
2019	Santry Demesne pNHA	0.0109	0.0001	0.0207	0.0013	0.500	0.506
	Baldoyle Bay SAC	0.0070	0.0001	0.0133	0.0008	0.500	0.504
2020	Santry Demesne pNHA	0.0087	0.0001	0.0164	0.0010	0.500	0.504
	Baldoyle Bay SAC	0.0071	0.0001	0.0134	0.0008	0.500	0.504
2021	Santry Demesne pNHA	0.0112	0.0001	0.0211	0.0013	0.500	0.506
	Baldoyle Bay SAC	0.0067	0.0001	0.0127	0.0008	0.500	0.503
2022	Santry Demesne pNHA	0.0097	0.0001	0.0184	0.0011	0.500	0.505
	Baldoyle Bay SAC	0.0067	0.0001	0.0127	0.0008	0.500	0.503

Cumulative Ecological Impact

NO_X

The cumulative NO_X modelling results are detailed in Table 9. Within the most impacted ecological habitat site (Santry Demense pNHA), at the worst-case location, cumulative emissions lead to an ambient NO_X concentration (including background) which is at most 61% of the annual limit value over the five years of meteorological data modelled.

Within the most impacted Natura 2000 designated habitat (Baldoyle Bay SAC), at the worst-case location, cumulative emissions lead to an ambient NO_X concentration (including background) which is at most 38% of the annual limit value over the five years of meteorological data modelled.

Table 9. Cumulative NO_X Dispersion Cumulative Model Results

Pollutant / Year	Designated Habitat	Annual Mean Process Contribution (µg/m³)	Annual Mean Back-ground (µg/m³)	Annual Mean Predicted Environmental Concentration (µg/m³)	Limit Value (µg/m³)	PEC % of Limit Value
NO_X / 2018	Santry Demense pNHA	0.94	17.10	18.04	30	60%
	Baldoyle Bay SAC	0.53	10.90	11.43		38%
NO_X / 2019	Santry Demense pNHA	0.94	17.10	18.04	30	60%
	Baldoyle Bay SAC	0.57	10.90	11.47		38%
NO_X / 2020	Santry Demense pNHA	0.94	17.10	18.04	30	60%
	Baldoyle Bay SAC	0.55	10.90	11.45		38%
NO_X / 2021	Santry Demense pNHA	1.11	17.10	18.21	30	61%
	Baldoyle Bay SAC	0.54	10.90	11.44		38%
NO_X / 2022	Santry Demense pNHA	0.90	17.10	18.00	30	60%
	Baldoyle Bay SAC	0.52	10.90	11.42		38%

SO_2

The SO_2 modelling results are detailed in Table 10. Within the most impacted ecological habitat site (Santry Demense pNHA), at the worst-case location, cumulative emissions lead to an ambient SO_2 concentration (including background) which is at most 9.2% of the annual limit value over the five years of meteorological data modelled.

Within the most impacted Natura 2000 designated habitat (Baldoyle Bay SAC), at the worst-case location, cumulative emissions lead to an ambient SO_2 concentration (including background) which is at most 9.1% of the annual limit value over the five years of meteorological data modelled.

Table 10. SO_2 Dispersion Cumulative Model Results

Pollutant / Year	Designated Habitat	Annual Mean Process Contribution (µg/m³)	Annual Mean Background (µg/m³)	Annual Mean Predicted Environmental Concentration (µg/m³)	Limit Value (µg/m³)	PEC % of Limit Value
SO_2 / 2018	Santry Demense pNHA	0.027	1.800	1.827	20.0	9.1%
	Baldoyle Bay SAC	0.015	1.800	1.815		9.1%
SO_2 / 2019	Santry Demense pNHA	0.027	1.800	1.827	20.0	9.1%
	Baldoyle Bay SAC	0.016	1.800	1.816		9.1%
SO_2 / 2020	Santry Demense pNHA	0.027	1.800	1.827	20.0	9.1%
	Baldoyle Bay SAC	0.015	1.800	1.815		9.1%
SO_2 / 2021	Santry Demense pNHA	0.032	1.800	1.832	20.0	9.2%
	Baldoyle Bay SAC	0.015	1.800	1.815		9.1%
SO_2 / 2022	Santry Demense pNHA	0.026	1.800	1.826	20.0	9.1%
	Baldoyle Bay SAC	0.015	1.800	1.815		9.1%

Nitrogen Deposition

In order to consider the effects of nitrogen deposition (as N) owing to cumulative emissions on the sensitive ecological habitat sites, the maximum annual mean NO_2 and NH_3 process contribution concentrations (PC) are converted into the dry deposition fluxes and then nitrogen deposition fluxes and shown in Table 11.

The nitrogen deposition flux for the worst-case year is 7.149 kg/ha/yr, shown in Table 11, and is below the range in worst-case critical loads of 10-15 kg/ha/yr [(2)] for the habitat types (hedgerow, tall herbs, calcareous grassland, reed fringe, open water, scrub and woodland) in the Santry Demense pNHA, indicating that the effects of nitrogen deposition on ecological habitat sites due cumulative emissions are not significant.

Within the most impacted Natura 2000 designated habitat (Baldoyle Bay SAC), at the worst-case location, the nitrogen deposition flux for the worst-case year is 6.077 kg/ha/yr, shown in Table 11. This is within the range in worst-case critical loads of 5-10 kg/ha/yr[(2)] for the "Atlantic salt meadows (Glauco-Puccinellietalia maritimae)", indicating that the effects of nitrogen deposition on designated sites due to cumulative emissions are not significant.

Table 11. Cumulative Operations – Nitrogen Deposition

Met. Year	Designated Habitat	NO_2 Annual Mean PC ($\mu g/m^3$)	NH_3 Annual Mean PC ($\mu g/m^3$)	NO_2 Dry Deposition ($\mu g/m^2/s$)	NH_3 Dry Deposition ($\mu g/m^2/s$)	NO_2 Acid Deposition (keq/ha/year)	NH_3 Acid Deposition (keq/ha/year)	APIS Background Nitrogen Deposition (kg/ha/yr)	Total (NO_2 + NH_3) PEC Nitrogen Deposition kg/ha/yr
2018	Santry Demesne pNHA	0.84	0.0009	0.0013	0.00002	0.121	0.0047	7.0	7.126
	Baldoyle Bay SAC	0.48	0.0005	0.0007	0.00001	0.069	0.0028	6.0	6.071
2019	Santry Demesne pNHA	0.85	0.0011	0.0013	0.00002	0.122	0.0055	7.0	7.127
	Baldoyle Bay SAC	0.51	0.0005	0.0008	0.00001	0.074	0.0027	6.0	6.077
2020	Santry Demesne pNHA	0.84	0.0006	0.0013	0.00001	0.122	0.0032	7.0	7.125
	Baldoyle Bay SAC	0.49	0.0005	0.0007	0.00001	0.071	0.0027	6.0	6.073
2021	Santry Demesne pNHA	1.00	0.0011	0.0015	0.00002	0.144	0.0055	7.0	7.149
	Baldoyle Bay SAC	0.48	0.0005	0.0007	0.00001	0.070	0.0027	6.0	6.072
2022	Santry Demesne pNHA	0.81	0.0009	0.0012	0.00002	0.117	0.0045	7.0	7.121
	Baldoyle Bay SAC	0.46	0.0005	0.0007	0.00001	0.067	0.0025	6.0	6.069

Acid Deposition

In order to consider the effects of acid deposition (as N) owing to cumulative emissions on the most impacted ecological habitat site, the maximum annual mean NO_2 process contribution concentrations (PC) are converted into the dry deposition fluxes and then acid deposition fluxes as shown in Table 12 and Table 13.

Within the most impacted ecological habitat site (Santry Demense pNHA), at the worst-case location, the total acid deposition (as N) flux for the worst-case year is 0.514 keq/ha/yr, as shown in Table 12 and Table 3.

This is below the worst case maximum critical load range of 0.714 – 5.146 keq/ha/yr for the habitats (hedgerow, tall herbs, calcareous grassland, reed fringe, open water, scrub and woodland) in the Santry Demense pNHA, indicating that the effects of acid deposition (as N) on ecological habitat sites due to cumulative emissions are not significant.

Within the most impacted Natura 2000 designated habitat (Baldoyle Bay SAC), at the worst-case location, the total acid deposition (as N) flux for the worst-case year is 0.507 keq/ha/yr, as shown in Table 12 and Table 13.

This is below the worst case maximum critical load range of 0.714 – 5.007 keq/ha/yr for the "Fixed coastal dunes with herbaceous vegetation (grey dunes)", indicating that the effects of acid deposition (as N) on designated sites due to cumulative emissions are not significant.

Table 12. Acid Deposition (as N) at Most Impacted Ecological Habitat Sites – Cumulative Operations

Met. Year	Designated Habitat	NO_2 Annual Mean PC ($\mu g/m^3$)	NH_3 Annual Mean PC ($\mu g/m^3$)	NO_2 Dry Deposition ($\mu g/m^2/s$)	NH_3 Dry Deposition ($\mu g/m^2/s$)	NO_2 Acid Deposition (keq/ha/ year)	NH_3 Acid Deposition (keq/ha/ year)	Total (NO_2 + NH_3) PC Acid Deposition (as N) keq/ha/yr)
2018	Santry Demesne pNHA	0.841	0.0009	0.0013	0.00002	0.009	0.0003	0.009
	Baldoyle Bay SAC	0.477	0.0005	0.0007	0.00001	0.005	0.0002	0.005
2019	Santry Demesne pNHA	0.848	0.0011	0.0013	0.00002	0.009	0.0004	0.009
	Baldoyle Bay SAC	0.514	0.0005	0.0008	0.00001	0.005	0.0002	0.005
2020	Santry Demesne pNHA	0.845	0.0006	0.0013	0.00001	0.009	0.0002	0.009
	Baldoyle Bay SAC	0.491	0.0005	0.0007	0.00001	0.005	0.0002	0.005
2021	Santry Demesne pNHA	0.999	0.0011	0.0015	0.00002	0.010	0.0004	0.011
	Baldoyle Bay SAC	0.483	0.0005	0.0007	0.00001	0.005	0.0002	0.005
2022	Santry Demesne pNHA	0.813	0.0009	0.0012	0.00002	0.008	0.0003	0.009
	Baldoyle Bay SAC	0.464	0.0005	0.0007	0.00001	0.005	0.0002	0.005

Table 13. Cumulative Operations – Acid Deposition (as S)

Year	Designated Habitat	SO_2 Annual Mean PEC ($\mu g/m^3$)	SO_2 Dry Deposition ($\mu g/m^2/s$)	SO_2 Sulphur Deposition (kg/ha/year)	SO_2 Acid Deposition (as S) (keq/ha/ year)	APIS Background Acid Deposition (keq/ha/yr)	Total (NO_2 + NH_3 +SO_2) PEC Acid Deposition (keq/ha/yr)
2018	Santry Demesne pNHA	0.027	0.0003	0.050	0.003	0.500	0.512
	Baldoyle Bay SAC	0.015	0.0002	0.028	0.002	0.500	0.507

Year	Designated Habitat	SO_2 Annual Mean PEC ($\mu g/m^3$)	SO_2 Dry Deposition ($\mu g/m^2/s$)	SO_2 Sulphur Deposition (kg/ha/year)	SO_2 Acid Deposition (as S) (keq/ha/ year)	APIS Background Acid Deposition (keq/ha/yr)	Total (NO_2 + NH_3 +SO_2) PEC Acid Deposition (keq/ha/yr)
2019	Santry Demesne pNHA	0.027	0.0003	0.050	0.003	0.500	0.512
	Baldoyle Bay SAC	0.016	0.0002	0.030	0.002	0.500	0.507
2020	Santry Demesne pNHA	0.027	0.0003	0.051	0.003	0.500	0.512
	Baldoyle Bay SAC	0.015	0.0002	0.029	0.002	0.500	0.507
2021	Santry Demesne pNHA	0.032	0.0004	0.060	0.004	0.500	0.514
	Baldoyle Bay SAC	0.015	0.0002	0.029	0.002	0.500	0.507
2022	Santry Demesne pNHA	0.026	0.0003	0.048	0.003	0.500	0.512
	Baldoyle Bay SAC	0.015	0.0002	0.027	0.002	0.500	0.507

Request 2.(a) and 2.(b)

2. The executive summary states that "There are no significant impacts predicted for any other Natura 2000 SPAs and SACs, as these are all further from the facility than the Baldoyle Bay SAC." It is noted that section 2.3 states that Baldoyle Bay SAC is 5km east of the site, South Dublin Bay and River Tolka Estuary SPA is situated almost 4 km to the south and North Dublin Bay and North Bull Island are located over 4 km to the east.
    a. Confirm that the assessment was not only performed for Baldoyle Bay SAC and that the assessment of potential impacts on SACs and SPAs included all relevant SACs and SPAs.
    b. Provide the results of the assessments for both the closest SPA/SAC and the SAC/SPA which modelling shows may have the potential to be the most impacted (noting these may or may not be the same SAC/ SPA)?

Response 2.(a) and 2.(b)

All nearby ecologically sensitive receptors are outlined in the response to 1(a) (see previous section). The closest Natura 2000 designated habitat (South Dublin Bay & River Tolka Estuary SPA) is at a distance of approximately 4km south of the facility. At the worst-case location in the South Dublin Bay & River Tolka Estuary SPA, emissions from the facility lead to an ambient NO_X concentration (including background) which is at most 99% of the annual limit value over the five years of meteorological data modelled as shown in Table 14 although the impact of the facility (without background) at this location is less than 0.2% of the annual limit value.

Table 14. NO_X Dispersion Model Results

Pollutant / Year	Designated Habitat	Annual Mean Process Contribution ($\mu g/m^3$)	Annual Mean Back-ground ($\mu g/m^3$)	Annual Mean Predicted Environmental Concentration ($\mu g/m^3$)	Limit Value ($\mu g/m^3$)	PEC % of Limit Value
2018	South Dublin Bay & River Tolka Estuary SPA	0.05	29.79	29.84	30	99%
2019	South Dublin Bay & River Tolka Estuary SPA	0.03	29.79	29.82	30	99%
2020	South Dublin Bay & River Tolka Estuary SPA	0.04	29.79	29.83	30	99%

Pollutant / Year	Designated Habitat	Annual Mean Process Contribution (µg/m³)	Annual Mean Back-ground (µg/m³)	Annual Mean Predicted Environmental Concentration (µg/m³)	Limit Value (µg/m³)	PEC % of Limit Value
2021	South Dublin Bay & River Tolka Estuary SPA	0.05	29.79	29.84	30	99%
2022	South Dublin Bay & River Tolka Estuary SPA	0.03	29.79	29.82	30	99%

NH_3

The NH_3 modelling results are detailed in Table 15. Within the closest Natura 2000 designated habitat (South Dublin Bay & River Tolka Estuary SPA), at the worst-case location, emissions from the facility lead to an ambient NH_3 concentration (including background) which is at most 42% of the annual limit value over the five years of meteorological data modelled.

Table 15. NH_3 Dispersion Model Results

Pollutant / Year	Designated Habitat	Annual Mean Process Contribution (µg/m³)	Annual Mean Back-ground (µg/m³)	Annual Mean Predicted Environmental Concentration (µg/m³)	Limit Value (µg/m³)	PEC % of Limit Value
2018	South Dublin Bay & River Tolka Estuary SPA	0.00008	1.27	1.2701	3	42%
2019	South Dublin Bay & River Tolka Estuary SPA	0.00007	1.27	1.2701	3	42%
2020	South Dublin Bay & River Tolka Estuary SPA	0.00007	1.27	1.2701	3	42%
2021	South Dublin Bay & River Tolka Estuary SPA	0.00012	1.27	1.2701	3	42%
2022	South Dublin Bay & River Tolka Estuary SPA	0.00006	1.27	1.2701	3	42%

SO_2

The SO_2 modelling results are detailed in Table 16. Within the closest Natura 2000 designated habitat (South Dublin Bay & River Tolka Estuary SPA), at the worst-case location, emissions from the facility lead to an ambient SO_2 concentration (including background) which is at most 37% of the annual limit value over the five years of meteorological data modelled.

Table 16. SO_2 Dispersion Model Results

Pollutant / Year	Designated Habitat	Annual Mean Process Contribution (µg/m³)	Annual Mean Back-ground (µg/m³)	Annual Mean Predicted Environmental Concentration (µg/m³)	Limit Value (µg/m³)	PEC % of Limit Value
2018	South Dublin Bay & River Tolka Estuary SPA	0.0012	7.4	7.4012	20	37%

Pollutant / Year	Designated Habitat	Annual Mean Process Contribution (µg/m³)	Annual Mean Back-ground (µg/m³)	Annual Mean Predicted Environmental Concentration (µg/m³)	Limit Value (µg/m³)	PEC % of Limit Value
2019	South Dublin Bay & River Tolka Estuary SPA	0.0009	7.4	7.4009	20	37%
2020	South Dublin Bay & River Tolka Estuary SPA	0.0009	7.4	7.4009	20	37%
2021	South Dublin Bay & River Tolka Estuary SPA	0.0014	7.4	7.4014	20	37%
2022	South Dublin Bay & River Tolka Estuary SPA	0.0009	7.4	7.4009	20	37%

Nitrogen Deposition

In order to consider the effects of nitrogen deposition (as N) owing to emissions from the facility on the sensitive ecological habitat sites, the maximum annual mean NO_2 and NH_3 process contribution concentrations (PC) are converted into the dry deposition fluxes and then nitrogen deposition fluxes and shown in Table 17.

Within the closest Natura 2000 designated habitat (South Dublin Bay & River Tolka Estuary SPA), at the worst-case location, the nitrogen deposition flux for the worst-case year is 6.807 kg/ha/yr, shown in Table 17. This is within the range in worst-case critical loads of 5-10 kg/ha/yr[(2)] for the "Atlantic salt meadows (Glauco-Puccinellietalia maritimae)", indicating that the effects of nitrogen deposition on designated sites due to the facility are not significant.

Table 17. Normal Operations – Nitrogen Deposition

Met. Year	Designated Habitat	NO_2 Annual Mean PC (µg/m³)	NH_3 Annual Mean PC (µg/m³)	NO_2 Dry Deposition (µg/m²/s)	NH_3 Dry Deposition (µg/m²/s)	NO_2 Acid Deposition (keq/ha/year)	NH_3 Acid Deposition (keq/ha/year)	APIS Background Nitrogen Deposition (kg/ha/yr)	Total (NO_2 + NH_3) PEC Nitrogen Deposition kg/ha/yr
2018	South Dublin Bay & River Tolka Estuary SPA	0.04	0.000077	0.000062	0.000002	0.0059	0.0004	6.8	6.806
2019	South Dublin Bay & River Tolka Estuary SPA	0.03	0.000066	0.000044	0.000001	0.0042	0.0003	6.8	6.805
2020	South Dublin Bay & River Tolka Estuary SPA	0.03	0.000066	0.000048	0.000001	0.0046	0.0003	6.8	6.805
2021	South Dublin Bay & River Tolka Estuary SPA	0.05	0.000121	0.000071	0.000002	0.0068	0.0006	6.8	6.807
2022	South Dublin Bay & River Tolka Estuary SPA	0.03	0.000055	0.000046	0.000001	0.0044	0.0003	6.8	6.805

Acid Deposition

In order to consider the effects of acid deposition (as N) owing to emissions from the facility on the closest ecological habitat site, the maximum annual mean NO_2 process contribution concentrations (PC) are converted into the dry deposition fluxes and then acid deposition fluxes and shown in Table 18 and Table 19.

Within the closest Natura 2000 designated habitat (South Dublin Bay & River Tolka Estuary SPA), at the worst-case location, the total acid deposition (as N) flux for the worst-case year is 0.591 keq/ha/yr, shown in Table 18 and Table 19.

This is below the worst case maximum critical load range of 0.714 – 5.007 keq/ha/yr for the "Fixed coastal dunes with herbaceous vegetation (grey dunes)", indicating that the effects of acid deposition (as N) on designated sites due to the facility are not significant.

Table 18. Acid Deposition (as N) at The Closest Ecological Habitat Sites – Normal Operations

Met. Year	Designated Habitat	NO_2 Annual Mean PC ($\mu g/m^3$)	NH_3 Annual Mean PC ($\mu g/m^3$)	NO_2 Dry Deposition ($\mu g/m^2/s$)	NH_3 Dry Deposition ($\mu g/m^2/s$)	NO_2 Acid Deposition (keq/ha/ year)	NH_3 Acid Deposition (keq/ha/ year)	Total (NO_2 + NH_3) PC Acid Deposition (as N) (keq/ha/yr)
2018	South Dublin Bay & River Tolka Estuary SPA	0.041	0.00008	0.00006	0.000002	0.00042	0.00003	0.00045
2019	South Dublin Bay & River Tolka Estuary SPA	0.030	0.00007	0.00004	0.000001	0.00030	0.00002	0.00033
2020	South Dublin Bay & River Tolka Estuary SPA	0.032	0.00007	0.00005	0.000001	0.00033	0.00002	0.00035
2021	South Dublin Bay & River Tolka Estuary SPA	0.048	0.00012	0.00007	0.000002	0.00049	0.00004	0.00053
2022	South Dublin Bay & River Tolka Estuary SPA	0.030	0.00006	0.00005	0.000001	0.00031	0.00002	0.00033

Table 19. Normal Operations – Acid Deposition (as S)

Year	Designated Habitat	SO_2 Annual Mean PEC ($\mu g/m^3$)	SO_2 Dry Deposition ($\mu g/m^2/s$)	SO_2 Sulphur Deposition (kg/ha/year)	SO_2 Acid Deposition (as S) (keq/ha/year)	APIS Background Acid Deposition (keq/ha/yr)	Total (NO_2 + NH_3 +SO_2) PEC Acid Deposition (keq/ha/yr)
2018	South Dublin Bay & River Tolka Estuary SPA	0.0012	0.00001	0.00227	0.00014	0.59	0.5906
2019	South Dublin Bay & River Tolka Estuary SPA	0.0009	0.00001	0.00161	0.00010	0.59	0.5904
2020	South Dublin Bay & River Tolka Estuary SPA	0.0009	0.00001	0.00176	0.00011	0.59	0.5905
2021	South Dublin Bay & River Tolka Estuary SPA	0.0014	0.00002	0.00259	0.00016	0.59	0.5907

Year	Designated Habitat	SO_2 Annual Mean PEC ($\mu g/m^3$)	SO_2 Dry Deposition ($\mu g/m^2/s$)	SO_2 Sulphur Deposition (kg/ha/year)	SO_2 Acid Deposition (as S) (keq/ha/yea r)	APIS Background Acid Deposition (keq/ha/yr)	Total (NO_2 + NH_3 +SO_2) PEC Acid Deposition (keq/ha/yr)
2022	South Dublin Bay & River Tolka Estuary SPA	0.0009	0.00001	0.00168	0.00011	0.59	0.5904

Cumulative Ecological Impact

NO_X

The cumulative NO_X modelling results are detailed in Table 20. Within the closest Natura 2000 designated habitat (South Dublin Bay & River Tolka Estuary SPA), at the worst-case location, cumulative emissions lead to an ambient NO_X concentration (including background) which is at most 99.7% of the annual limit value over the five years of meteorological data modelled.

NH_3

NH_3 results are the same as per Table 15.

Table 20. Cumulative NO_X Dispersion Model Results

Pollutant / Year	Designated Habitat	Annual Mean Process Contribution (µg/m³)	Annual Mean Back-ground (µg/m³)	Annual Mean Predicted Environmental Concentration (µg/m³)	Limit Value (µg/m³)	PEC % of Limit Value
2018	South Dublin Bay & River Tolka Estuary SPA	0.09	29.79	29.88	30	99.6%
2019	South Dublin Bay & River Tolka Estuary SPA	0.07	29.79	29.86	30	99.5%
2020	South Dublin Bay & River Tolka Estuary SPA	0.07	29.79	29.86	30	99.5%
2021	South Dublin Bay & River Tolka Estuary SPA	0.11	29.79	29.90	30	99.7%
2022	South Dublin Bay & River Tolka Estuary SPA	0.07	29.79	29.86	30	99.5%

SO_2

The cumulative SO_2 modelling results are detailed in Table 21. Within the closest Natura 2000 designated habitat (South Dublin Bay & River Tolka Estuary SPA), at the worst-case location, cumulative emissions lead to an ambient SO_2 concentration (including background) which is at most 37% of the annual limit value over the five years of meteorological data modelled.

Table 21. Cumulative SO_2 Dispersion Model Results

Pollutant / Year	Designated Habitat	Annual Mean Process Contribution (µg/m³)	Annual Mean Back-ground (µg/m³)	Annual Mean Predicted Environmental Concentration (µg/m³)	Limit Value (µg/m³)	PEC % of Limit Value
2018	South Dublin Bay & River Tolka Estuary SPA	0.0026	7.4	7.403	20	37%
2019	South Dublin Bay & River Tolka Estuary SPA	0.0019	7.4	7.402	20	37%
2020	South Dublin Bay & River Tolka Estuary SPA	0.0021	7.4	7.402	20	37%

Pollutant / Year	Designated Habitat	Annual Mean Process Contribution (µg/m³)	Annual Mean Back-ground (µg/m³)	Annual Mean Predicted Environmental Concentration (µg/m³)	Limit Value (µg/m³)	PEC % of Limit Value
2021	South Dublin Bay & River Tolka Estuary SPA	0.0030	7.4	7.403	20	37%
2022	South Dublin Bay & River Tolka Estuary SPA	0.0020	7.4	7.402	20	37%

Nitrogen Deposition

In order to consider the effects of nitrogen deposition (as N) owing to cumulative emissions on the sensitive ecological habitat sites, the maximum annual mean NO_2 and NH_3 process contribution concentrations (PC) are converted into the dry deposition fluxes and then nitrogen deposition fluxes and shown in Table 22.

Within the closest Natura 2000 designated habitat (South Dublin Bay & River Tolka Estuary SPA), at the worst-case location, the nitrogen deposition flux for the worst-case year is 6.814 kg/ha/yr, shown in Table 22. This is within the range in worst-case critical loads of 5-10 kg/ha/yr[(2)] for the "Atlantic salt meadows (Glauco-Puccinellietalia maritimae)", indicating that the effects of nitrogen deposition on designated sites due to the cumulative emissions are not significant.

Table 22. Cumulative Operations – Nitrogen Deposition

Met. Year	Designated Habitat	NO_2 Annual Mean PC (µg/m³)	NH_3 Annual Mean PC (µg/m³)	NO_2 Dry Deposition (µg/m²/s)	NH_3 Dry Deposition (µg/m²/s)	NO_2 Acid Deposition (keq/ha/year)	NH_3 Acid Deposition (keq/ha/year)	APIS Background Nitrogen Deposition (kg/ha/yr)	Total (NO_2 + NH_3) PEC Nitrogen Deposition kg/ha/yr
2018	South Dublin Bay & River Tolka Estuary SPA	0.08	0.00008	0.00013	0.000002	0.0120	0.0004	6.8	6.812
2019	South Dublin Bay & River Tolka Estuary SPA	0.06	0.00007	0.00009	0.000001	0.0089	0.0003	6.8	6.809
2020	South Dublin Bay & River Tolka Estuary SPA	0.07	0.00007	0.00010	0.000001	0.0095	0.0003	6.8	6.810
2021	South Dublin Bay & River Tolka Estuary SPA	0.10	0.00012	0.00014	0.000002	0.0138	0.0006	6.8	6.814
2022	South Dublin Bay & River Tolka Estuary SPA	0.06	0.00006	0.00009	0.000001	0.0089	0.0003	6.8	6.809

Acid Deposition

In order to consider the effects of acid deposition (as N) owing to cumulative emissions on the closest ecological habitat site, the maximum annual mean NO_2 process contribution concentrations (PC) are converted into the dry deposition fluxes and then acid deposition fluxes and shown in Table 23 and Table 24.

Within the closest Natura 2000 designated habitat (South Dublin Bay & River Tolka Estuary SPA), at the worst-case location, the total acid deposition (as N) flux for the worst-case year is 0.5914 keq/ha/yr, shown in Table 23 and Table 24.

This is below the worst case maximum critical load range of 0.714 – 5.007 keq/ha/yr for the "Fixed coastal dunes with herbaceous vegetation (grey dunes)", indicating that the effects of acid deposition (as N) on designated sites due to the facility are not significant.

Table 23. Acid Deposition (as N) at The Closest Ecological Habitat Sites – Cumulative Operations

Met. Year	Designated Habitat	NO_2 Annual Mean PC ($\mu g/m^3$)	NH_3 Annual Mean PC ($\mu g/m^3$)	NO_2 Dry Deposition ($\mu g/m^2/s$)	NH_3 Dry Deposition ($\mu g/m^2/s$)	NO_2 Acid Deposition (keq/ha/year)	NH_3 Acid Deposition (keq/ha/year)	Total (NO_2 + NH_3) PC Acid Deposition (as N) keq/ha/yr)
2018	South Dublin Bay & River Tolka Estuary SPA	0.08	0.00008	0.00013	0.000002	0.0009	0.00003	0.00089
2019	South Dublin Bay & River Tolka Estuary SPA	0.06	0.00007	0.00009	0.000001	0.0006	0.00002	0.00066
2020	South Dublin Bay & River Tolka Estuary SPA	0.07	0.00007	0.00010	0.000001	0.0007	0.00002	0.00070
2021	South Dublin Bay & River Tolka Estuary SPA	0.10	0.00012	0.00014	0.000002	0.0010	0.00004	0.00103
2022	South Dublin Bay & River Tolka Estuary SPA	0.06	0.00006	0.00009	0.000001	0.0006	0.00002	0.00066

Table 24. Cumulative Operations – Acid Deposition (as S)

Year	Designated Habitat	SO_2 Annual Mean PEC ($\mu g/m^3$)	SO_2 Dry Deposition ($\mu g/m^2/s$)	SO_2 Sulphur Deposition (kg/ha/year)	SO_2 Acid Deposition (as S) (keq/ha/year)	APIS Background Acid Deposition (keq/ha/yr)	Total (NO_2 + NH_3 +SO_2) PEC Acid Deposition (keq/ha/yr)
2018	South Dublin Bay & River Tolka Estuary SPA	0.003	0.00003	0.005	0.0003	0.59	0.5912
2019	South Dublin Bay & River Tolka Estuary SPA	0.002	0.00002	0.004	0.0002	0.59	0.5909
2020	South Dublin Bay & River Tolka Estuary SPA	0.002	0.00002	0.004	0.0002	0.59	0.5909
2021	South Dublin Bay & River Tolka Estuary SPA	0.003	0.00004	0.006	0.0004	0.59	0.5914
2022	South Dublin Bay & River Tolka Estuary SPA	0.002	0.00002	0.004	0.0002	0.59	0.5909

Request 3:

3. Confirm what loading was used in the modelling for the generators during emergency operation.

Response to 3:

The emergency generators were modelled at 100% load for 150 hours per year.

The model also included the following types of testing of the back-up generators:

- **Test 1:** Testing once per week of all 52 no. back-up generators on the campus at 25% load for a maximum of 30 minutes each, one generator at a time, sequentially;
- **Test 2:** All 52 no. back-up generators will be periodically tested on an individual basis at 100% load for a maximum of 16 hours per year. This is incorporated into the dispersion model as each generator operating on an individual basis, at 100% load, for four hours, once per quarter (assumed to be January, April, June and October for the purpose of this assessment).

Request 4:

4. It is noted that Attachment 1-2 Non-Technical Summary refers to air modelling results based on 72 hours operation. Attachment 7-1-3-2 Air Emissions Impact Assessment states that "The UK EA assessment methodology determined that, in any year, the generators can run for 137 hours using diesel fuel before there is a likelihood of an exceedance at the nearest residential receptor (at a 98th percentile confidence level)" and "The UK EA assessment methodology determined that, in any year, the generators can run for 80 hours before there is a likelihood of an exceedance at the nearest residential receptor (at a 98th percentile confidence level." Attachment 7-1-3-2 Air Emissions Impact Assessment also models for 150 hours per year.
    a. Provide clarification on the number of hours requested as part of the application, and
    b. Provide justification on why those hours are acceptable for both UK and USEPA assessment methodology.

Response to 4:

AWS are requesting 150 hours of emergency operation based on the USEPA methodology. This approach was previously used by the EPA to determine the limitation on operational hours under the existing licence, and as such, it is appropriate to use the same methodology for the current request to extend the hours. The NTS summary is a typographical error and this should be 150 hours of operation. The variation between 150 hours per year and 137 hours per year is based on the use of two methodologies (USEPA and UKEA).

Using the USEPA methodology, the emergency generators were modelled at 100% load for 150 hours per year. A reduced emission rate based on USEPA protocol (assuming 150 hours / annum) was used to model emissions during emergency operation of generators (at 100% load). The hours of operation requested for the licence are those presented by the USEPA method (150 hours per annum). Therefore, the hours of operation requested for the licence are based on the USEPA methodology (150 hours per annum), as this was agreed with the EPA in prior assessments and remains a valid and appropriate method for evaluating emergency generator emissions.

Emissions of NO_2 from 45 of the 52 no. standby generators was also assessed using the UK Environment Agency methodology. The methodology, based on considering the statistical likelihood of an exceedance of the NO_2 hourly limit value assuming a hypergeometric distribution, has been undertaken at the worst-case residential receptor for the Facility Scenario. The

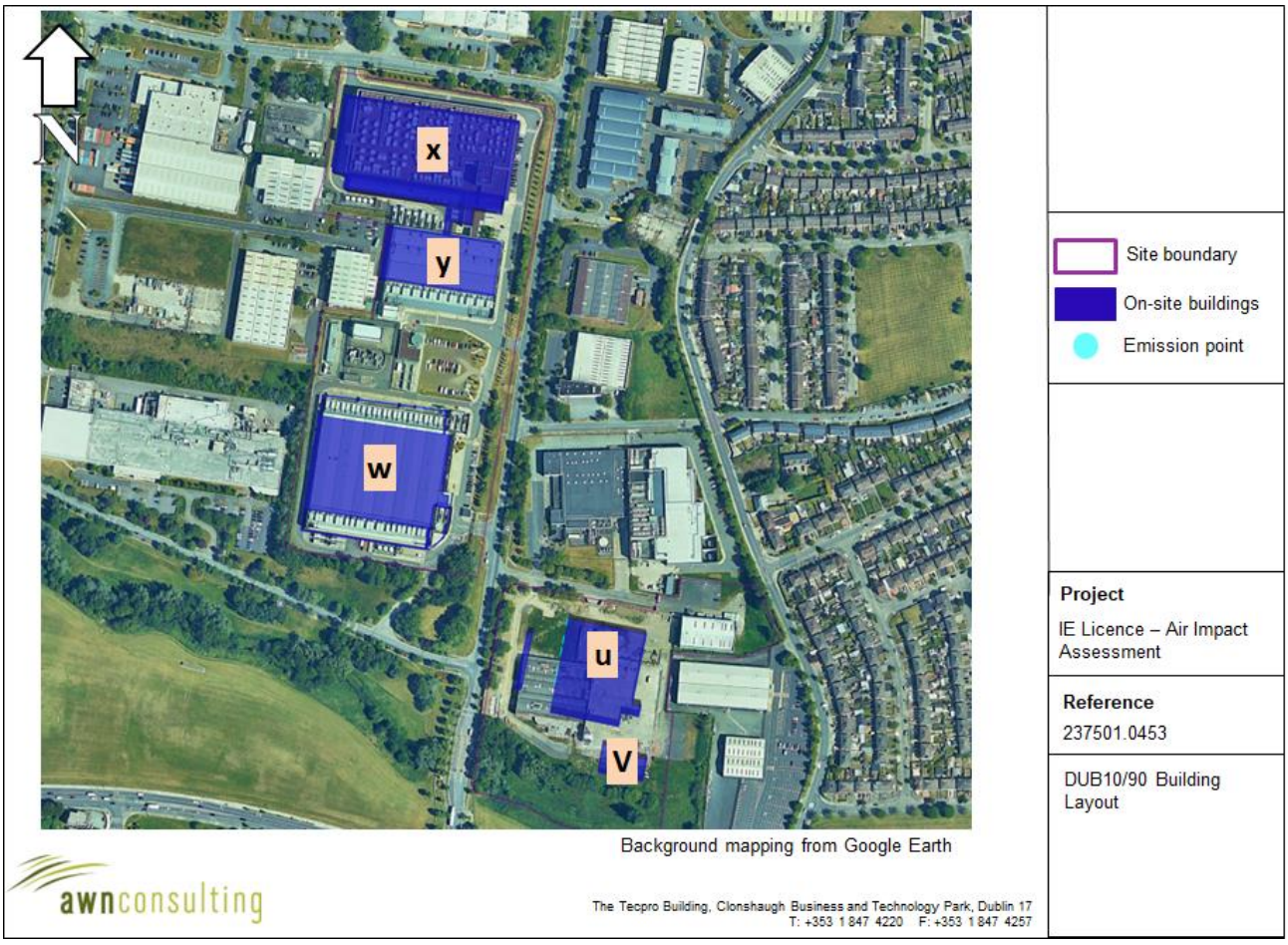
cumulative hypergeometric distribution of 19 and more hours per year is computed and the probability of an exceedance determined. The results were compared to the 98th percentile confidence level to indicate if an exceedance is likely at various operational hours for the diesel generators. The results indicate that in the worst-case year, the diesel generators can operate for 137 hours per year using diesel fuel before there is a likelihood of an exceedance of the ambient air quality standard (at a 98th percentile confidence level).

Request 5:

5. Diagram 1 appears to include a building labelled as Z and does not include buildings labelled as U and V. Update this diagram to ensure that building identification is accurate.

Response to 5:

Diagram 1 contained a typographical error. The correct building labelling is shown below:



Request 6.(a) and (b)

6. Section 4.0 Background concentrations of pollutants:
    a. Provide further justification on why an annual mean SO_2 of 4 μg/m^3 is appropriate considering the data from Dublin Airport shows an annual mean of 5.8 μg/m^3 in 2022.
    b. Provide the method used to calculate the 1-hour background for SO_2 and the 24-hour background concentration for SO_2. Justify why the background figures used are appropriate.

Response to 6.(a) and (b)

Continuous monitoring by the EPA is carried out at a number of monitoring stations within Zone A; these include urban background sites, roadside (traffic) sites, Dublin Airport and suburban background sites.

It is necessary to select monitoring stations that are representative of the site location. Not all monitoring stations are considered suitable for determining background pollutant concentrations and must be reviewed on a case-by-case basis to determine the most appropriate EPA monitoring sites for the current assessment.

The EPA, on their website[8], state that background sites generally represent overall area-wide exposure more closely than roadside sites. Roadside monitoring sites are heavily influenced by traffic emissions and are not considered representative of area-wide pollutant levels. The purpose of this assessment, and particularly the cumulative assessment, is to determine the predicted pollutant concentrations over a wide area, therefore roadside monitoring stations were not considered appropriate. Similarly, Dublin Airport will not be representative of the area-wide pollutant levels. Thus, the level of SO_2 at Dublin Airport (annual average of 5.8 μg/m^3) is only representative of a small area around Dublin Airport and would not be representative of levels in the region of Clonshaugh Business & Technology Park. Measurements at Rathmines and Ringsend will be more presentative of urban background levels in Dublin.

Continuous SO_2 monitoring carried out at the Zone A suburban background locations of Rathmines and Dublin Airport showed annual mean concentrations ranging from 1.7 – 5.8 μg/m^3 in 2022 (see Table 25). Sufficient data is available for Rathmines and Ringsend to observe trends over the period 2018 – 2022. Average annual mean SO_2 concentrations ranged from 1.1 – 3.3 μg/m^3 over the period of 2018 – 2022, suggesting an upper average concentration of no more than 3.3 μg/m^3. Based on this information, a conservative estimate of the background SO_2 concentration in the region of the facility is 4 μg/m^3. The 99.7th%ile of 1-hour means in 2022 ranged from 7.9 – 19.7 μg/m^3 whilst the 99.2th%ile of 24-hour means in 2022 ranged from 4.7 – 12.1 μg/m^3.

A 1-hour background of 51 μg/m^3 was used in the assessment based on the maximum 1-hour concentrations over the period 2018 – 2022 (Ringsend, 2018). A 24-hour background concentration of 20 μg/m^3 was used in the assessment based on the maximum 24-hour concentrations over the period 2018 – 2022 (Ringsend, 2018).

Table 25. Annual Mean, 1-Hour and 24-Hour Mean SO_2 Concentrations In Zone A Locations (μg/m^3)

Station	Averaging Period	Year				
		2018	2019	2020	2021	2022
Rathmines	Annual Mean SO_2 (μg/m^3)	2.3	1.3	1.4	1.1	1.8
	99.7th%ile of 1-hour mean SO_2 (μg/m^3)	25.0	29.3	14.6	23.1	7.9
	99.2th%ile of 24-hour mean SO_2 (μg/m^3)	8.0	4.3	5.1	6.1	4.7
	Annual Mean SO_2 (μg/m^3)	-	-	3.8	4.6	5.8

Station	Averaging Period	Year				
		2018	2019	2020	2021	2022
Dublin Airport	99.7th%ile of 1-hour mean SO_2 (µg/m^3)	-	-	20.2	23.9	13.3
	99.2th%ile of 24-hour mean SO_2 (µg/m^3)	-	-	13.6	18.4	12.1
Dublin Port	Annual Mean SO_2 (µg/m^3)	-	-	2.4	2.3	1.7
	99.7th%ile of 1-hour mean SO_2 (µg/m^3)	-	-	84.3	49.9	19.7
	99.2th%ile of 24-hour mean SO_2 (µg/m^3)	-	-	26.6	22.1	10.1
Ringsend	Annual Mean SO_2 (µg/m^3)	3.3	1.4	2.1	2.7	2.9
	99.7th%ile of 1-hour mean SO_2 (µg/m^3)	51.0	42.8	18.4	12.5	12.8
	99.2th%ile of 24-hour mean SO_2 (µg/m^3)	20.0	6.9	8.1	8.0	5.6

When calculating the short-term peak results, concentrations due to emissions from stacks cannot be combined by directly adding the annual background level to the modelling results. Guidance from the UK DEFRA(3) and EPA(6) advises that for SO_2 an estimate of the maximum combined pollutant concentrations can be obtained as shown below:

SO_2 - The 99.2th%ile of total 24-hour SO_2 is equal to the maximum of either A or B below:

a) 99.2th%ile of 24-hour mean background SO_2 + (2 x annual mean process contribution SO_2)
b) 99.2th%ile 24-hour mean process contribution SO_2 + (2 x annual mean background contribution SO_2)

SO_2 - The 99.7th%ile of total 1-hour SO_2 is equal to the maximum of either A or B below:

a) 99.7th%ile hourly background SO_2 + (2 x annual mean process contribution SO_2)
b) 99.7th%ile hourly process contribution SO_2 + (2 x annual mean background contribution SO_2)

Thus for **Year 2018**, the calculation for the maximum 1-hour PEC is as follows with the highest of the two results reported:

SO_2 - The 99.7th%ile of total 1-hour SO_2 is equal to the maximum of either A or B below:

a) 99.7th%ile hourly background SO_2 (51 µg/m^3) + (2 x annual mean process contribution SO_2 (2 X 0.747 µg/m^3) = **52.49 µg/m^3**

b) 99.7th%ile hourly process contribution SO_2 (17.5 µg/m^3) + (2 x annual mean background contribution SO_2) (2 x 4.0 µg/m^3) = **25.5 µg/m^3**

Thus for **Year 2018**, the calculation for the maximum 24-hour PEC is as follows with the highest of the two results reported:

SO_2 - The 99.2th%ile of total 24-hour SO_2 is equal to the maximum of either A or B below:

a) 99.2th%ile of 24-hour mean background SO_2 (20 µg/m^3) + (2 x annual mean process contribution SO_2) (2 X 0.747 µg/m^3) = **21.49 µg/m^3**

b) 99.2th%ile 24-hour mean process contribution SO_2 (5.4 µg/m^3) + (2 x annual mean background contribution SO_2) (2 x 4.0 µg/m^3) = **13.4 µg/m^3**

The results for 2019-2022 are also calculated in the same manner as outlined in Table 14 of the Air Assessment Impact Report for the IED Application.

Request 7:

7. It is noted that figures such as "Figure 2 Emergency Operations - Maximum 1-Hour NO_2 Concentrations (as a $99.8^{th\%ile}$) ($\mu g/m^3$) (including background concentrations)" include modelling results that according to the legend on the figure should be shown in red. However, no red colouring is visible on the figure. Update contour plots to ensure that the image is aligned to legend provided for the figure.

:

Response to 7:

The contour plots have been updated below in Figures 2 – 7 and Figure 9 – 10 to include red colouring in all contour plots.

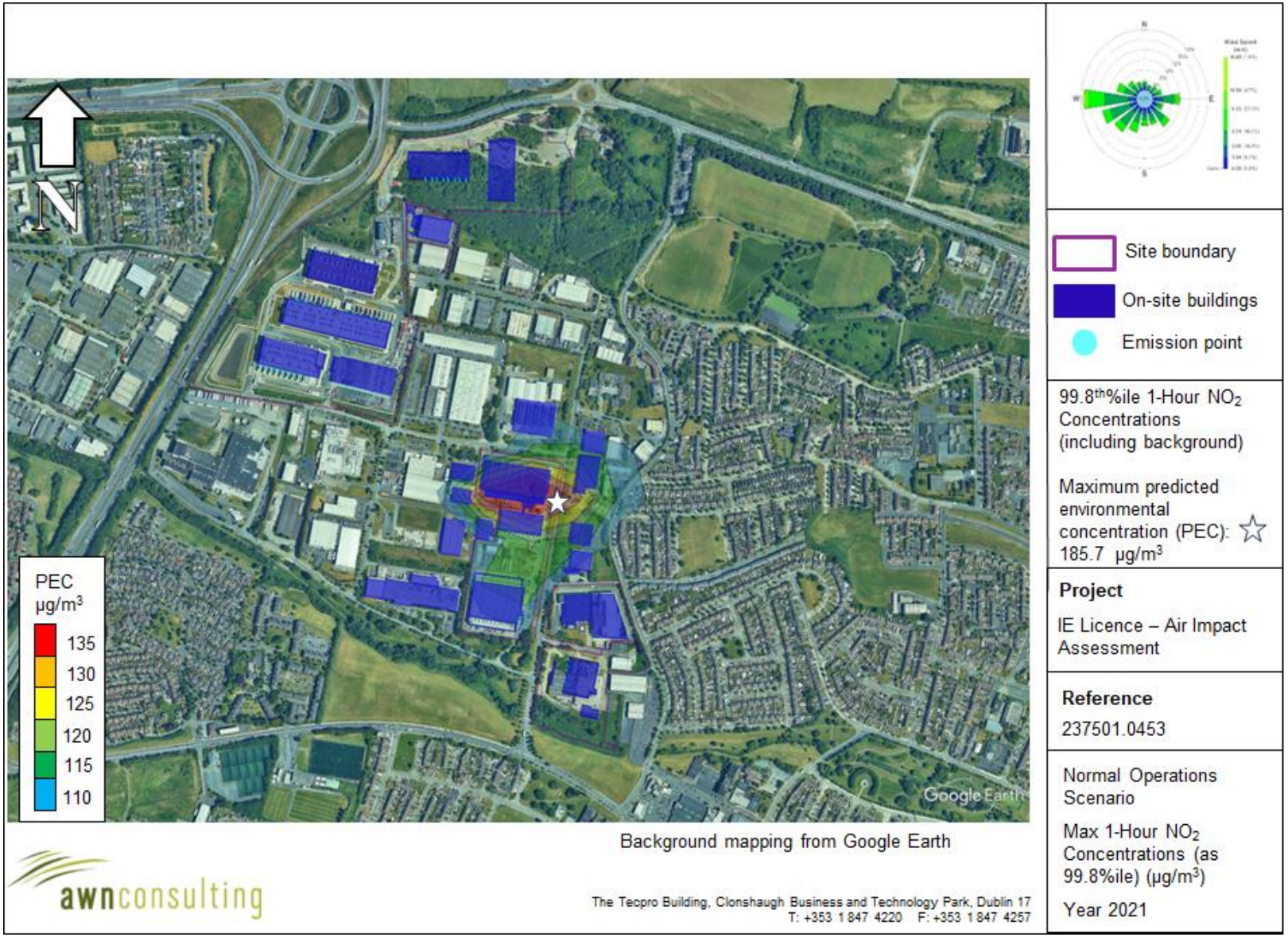


Figure 2 Maximum 1-Hour NO_2 Concentrations (as a 99.8th%ile) (µg/m^3) (including background concentrations)

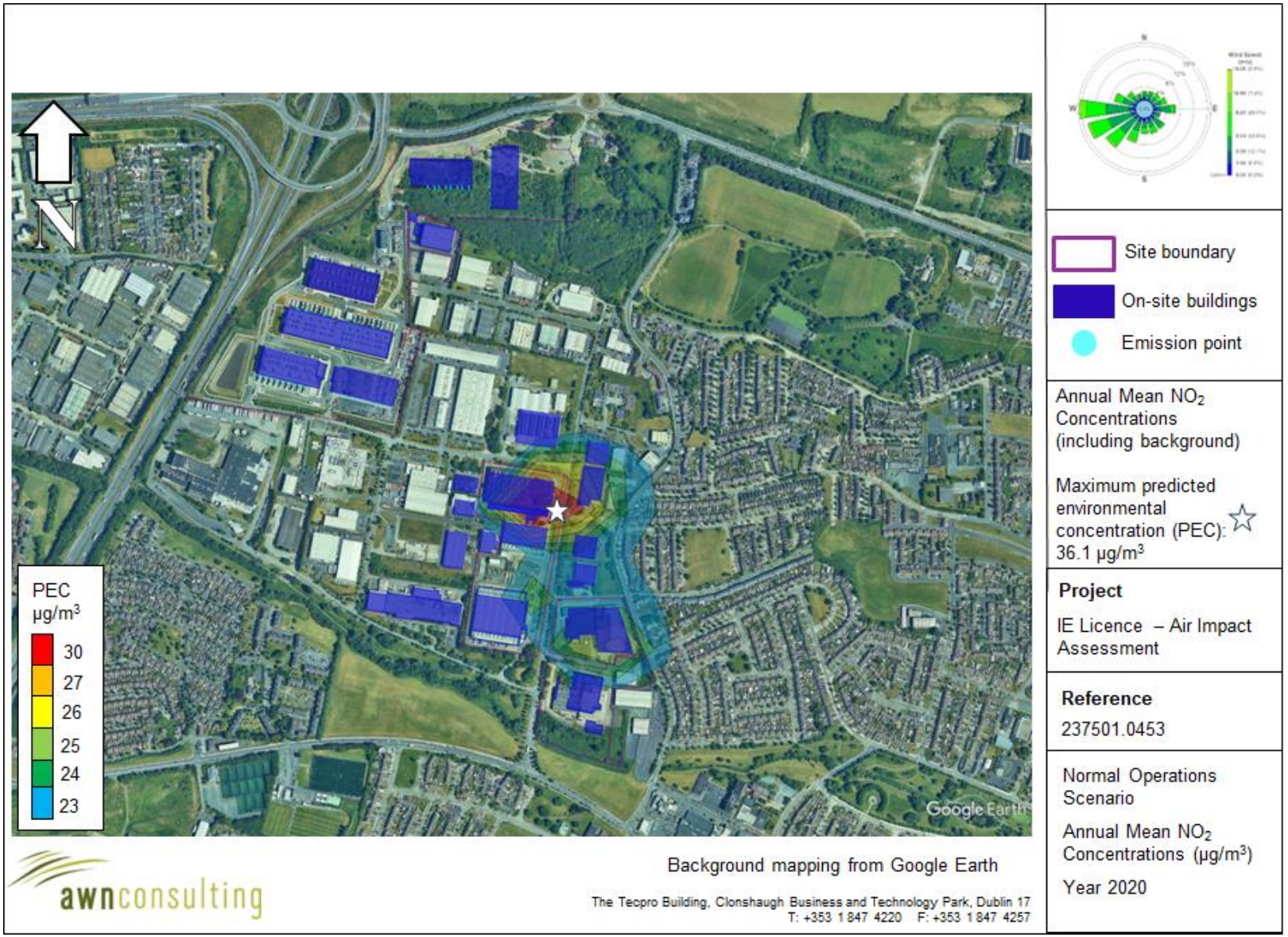


Figure 3 Annual Mean NO_2 Concentrations (µg/m^3) (including background concentrations)

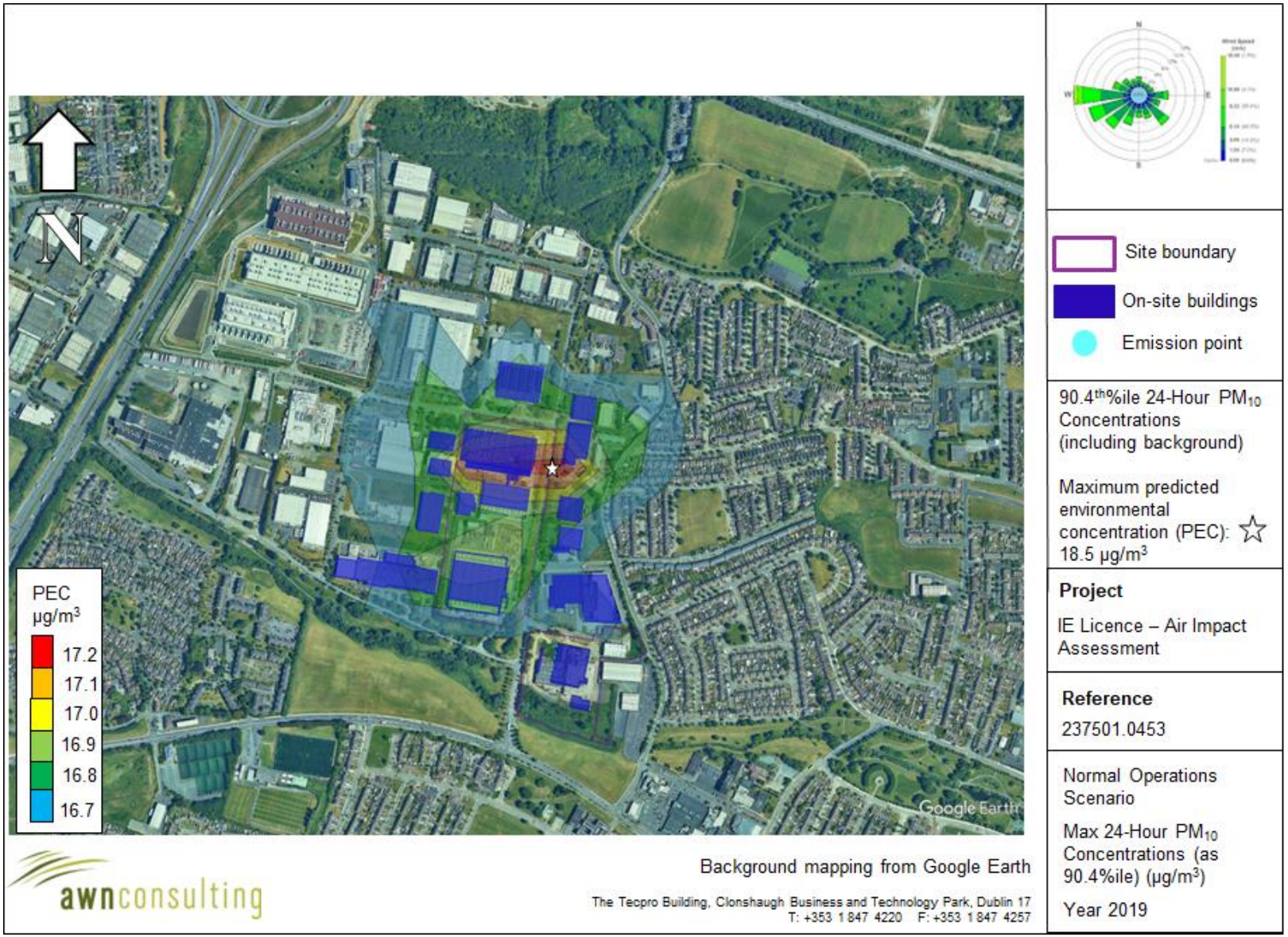


Figure 4 Maximum 24-Hour PM_{10} Concentration (µg/m³) (including background concentrations based on maximum process contribution and annual background concentration)

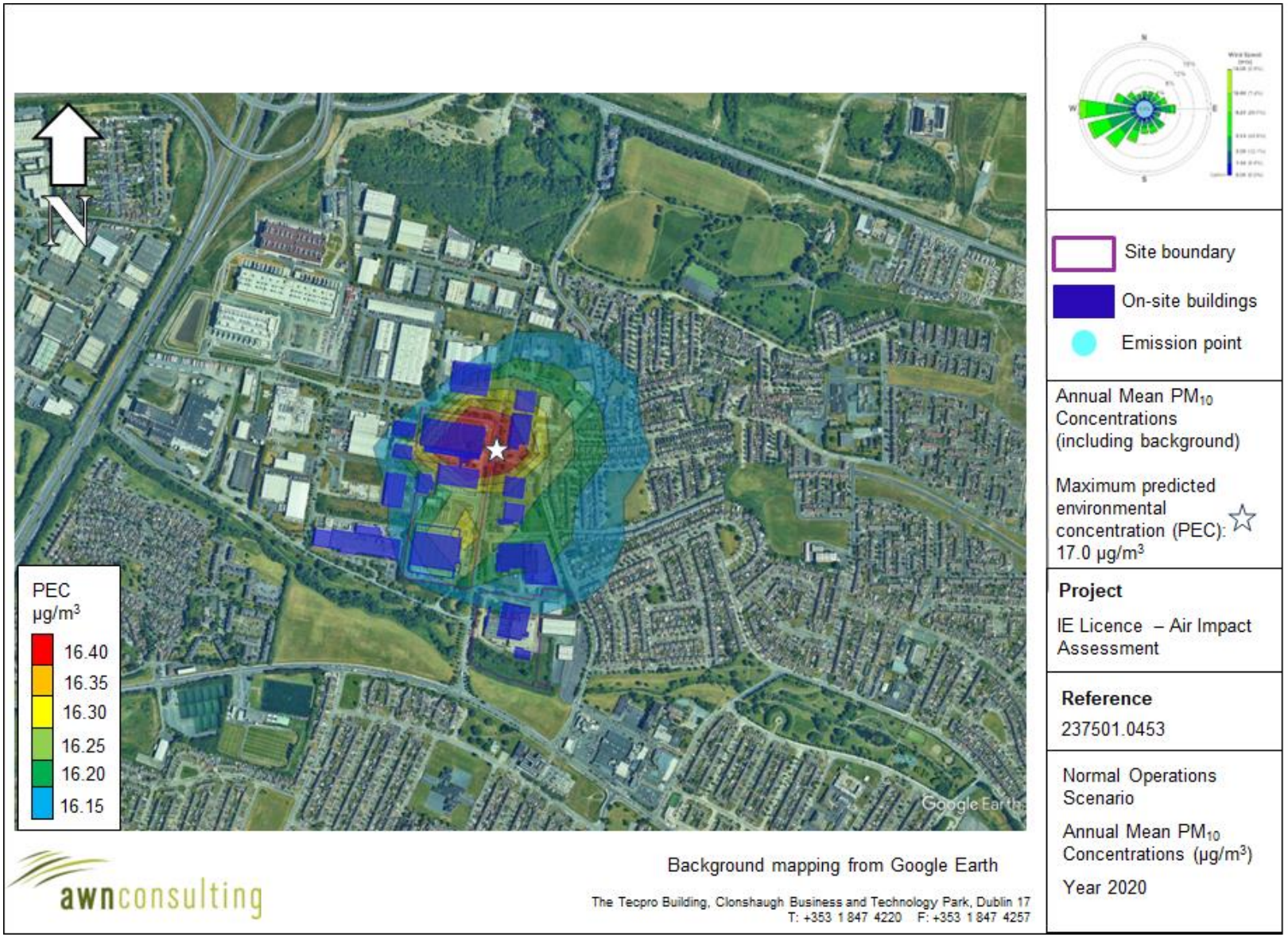


Figure 5 Annual Mean PM_{10} Concentration (µg/m^3) (including background concentrations)

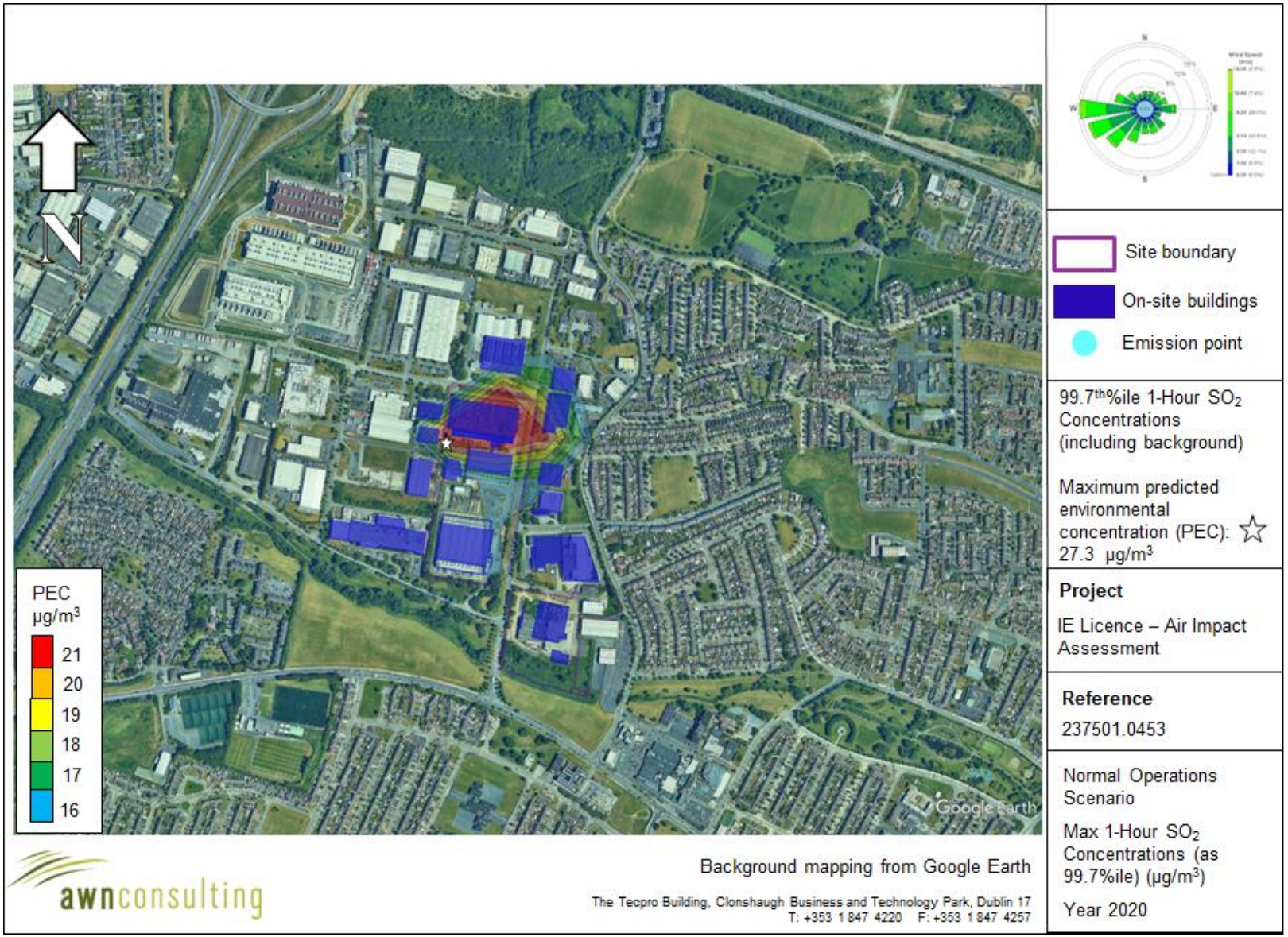


Figure 6 Maximum 1-Hour SO_2 Concentrations (as a 99.7th%ile) (µg/m^3) (including background concentrations based on maximum process contribution and 2 x annual background concentration)

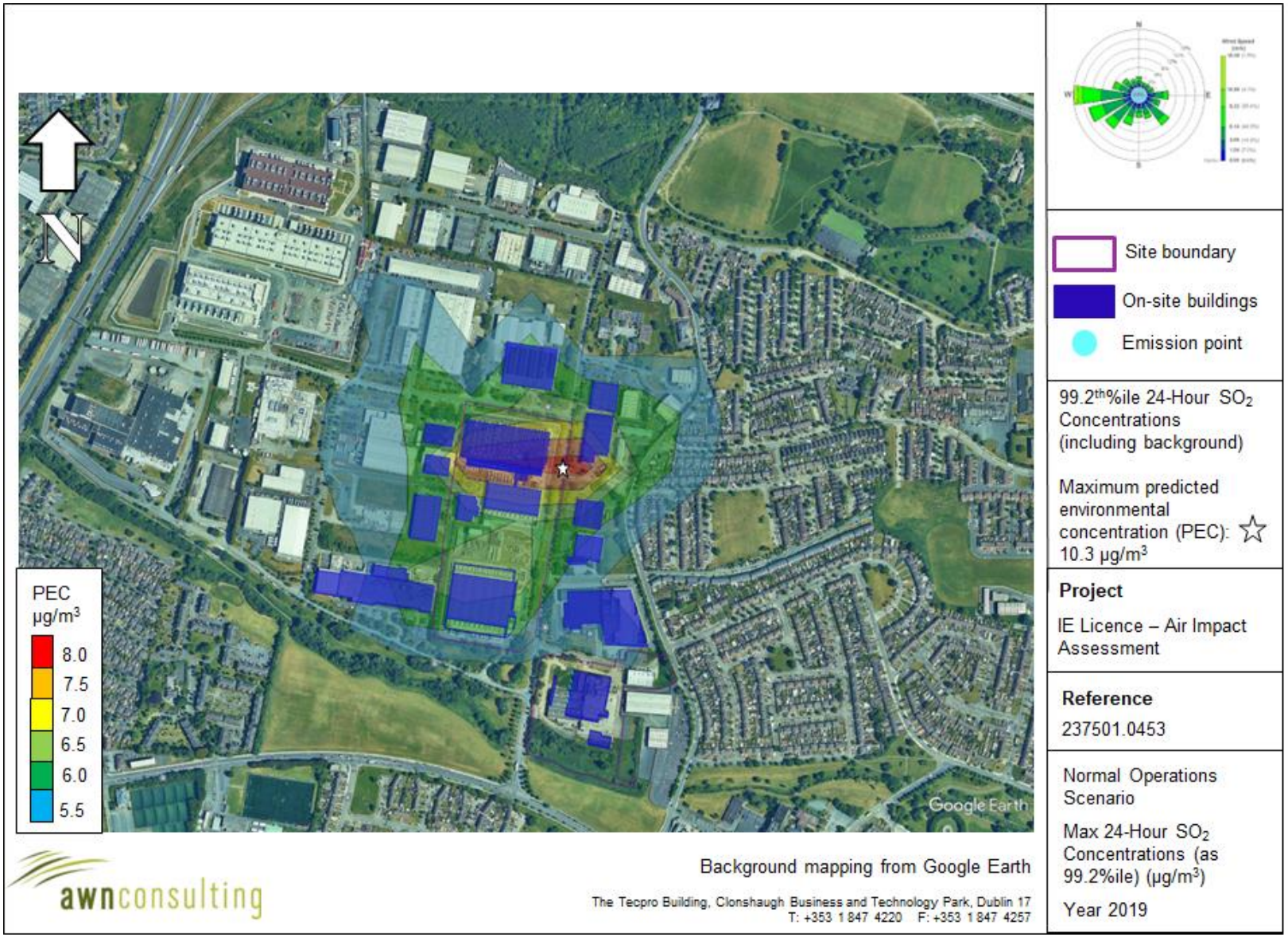


Figure 7 Maximum 24-Hour SO_2 Concentrations (as a 99.2th%ile) (including background concentrations based on maximum process contribution and 2 x annual background concentration)

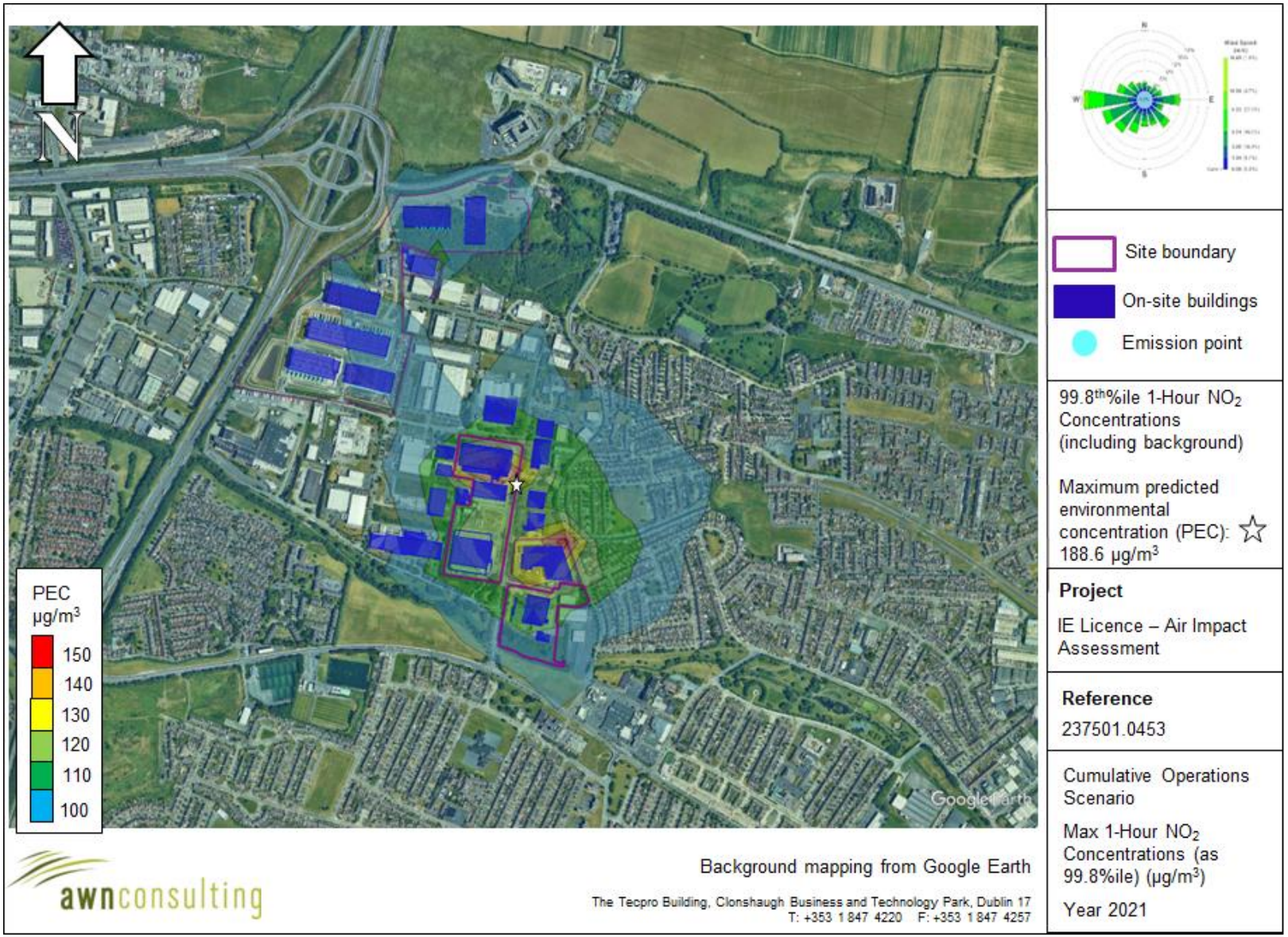


Figure 9 Cumulative Assessment - Maximum 1-Hour NO_2 Concentrations (as a 99.8th%ile) (µg/m^3) (including background concentrations)

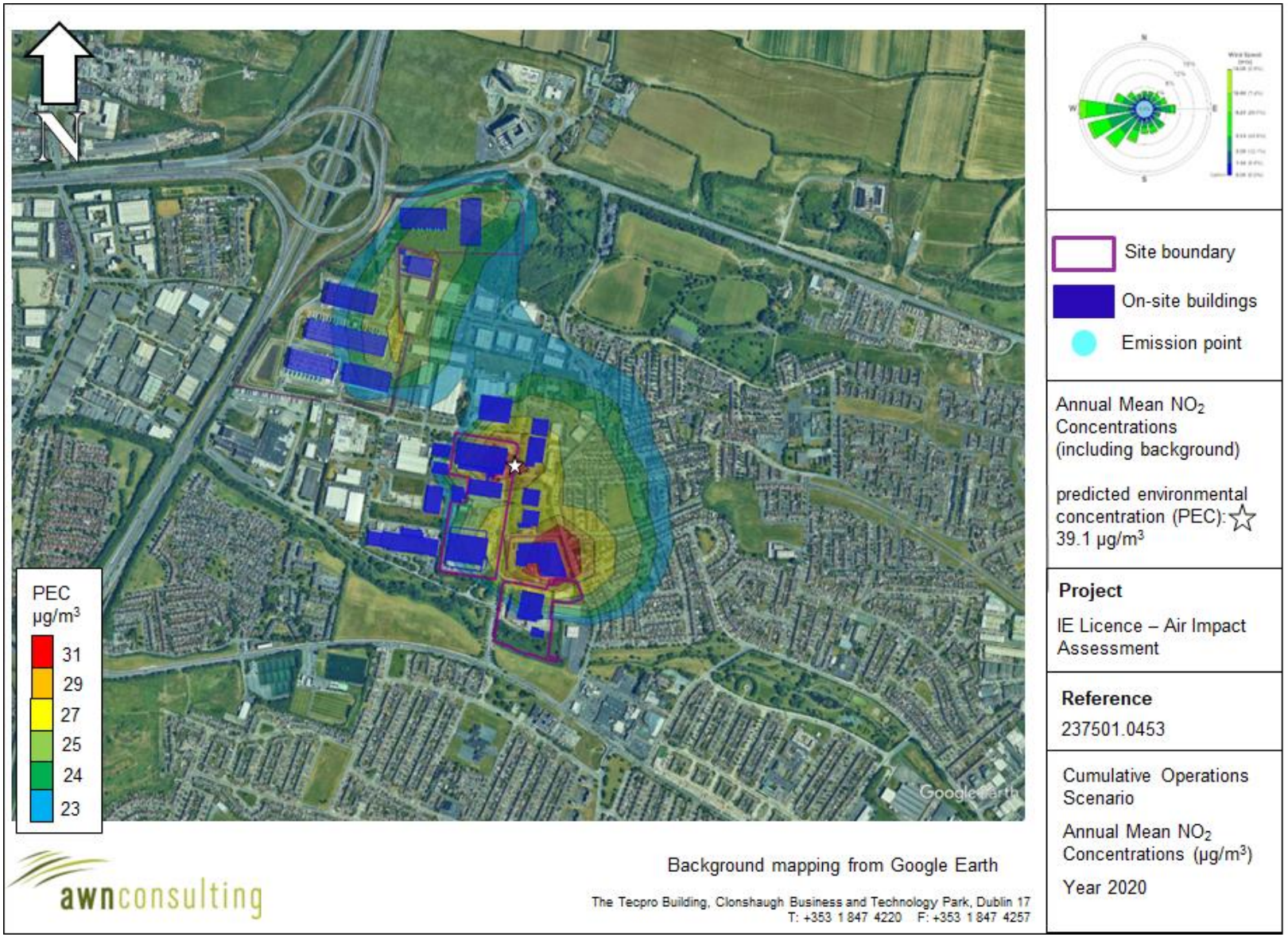


Figure 10 Cumulative Assessment - Annual Mean NO_2 Concentrations (µg/m^3) (including background concentrations)

Request 8:

8. It is noted that some contour plot figures include background while others exclude background. Update all contour plot figures to include background.

Response to 8:

The 24-hour mean PM_{10} predicted environmental concentration contours are displayed in Figure 4 using the 24-hour mean PM_{10} process contribution plus the annual mean background concentration. However, the methodology for calculating the PEC which is calculated in line with guidance from the UK DEFRA[3] and EPA[6], which states that the 90.4th%ile of 24-hour mean PM_{10} is equal to the maximum of either (a) or (b) below:

(a) 90.4th%ile of 24-hour mean background PM_{10} + annual mean process contribution PM_{10}

(b) 90.4th%ile 24-hour mean process contribution PM_{10} + annual mean background PM_{10}

the 24-hour mean (90.4th%ile) PM_{10} PEC using the above two methods results in a maximum PEC based on method (a). Therefore, a contour plot of the 24-hour mean (90.4th%ile) PEC would be based on the annual mean rather than demonstrating the plume behaviour of the 24-hour mean (90.4th%ile) process contribution. However, as outlined above the 24-hour mean PM_{10} process contribution plus the annual mean background concentration is shown for reference in Figure 4.

Similarly, the 24-hour mean SO_2 (99.2nd%ile) and the 1-hour mean SO_2 (99.7th%ile) predicted environmental concentration contours are displayed in Figure 6 and 7 using the 1-hour mean SO_2 process contribution and the 24-hour mean SO_2 process contribution two x annual mean background concentration respectively. However, the methodology for calculating the PEC which is calculated in line with guidance from the UK DEFRA[3] and EPA[6], which states that for SO_2 an estimate of the maximum combined pollutant concentrations can be obtained as shown below:

99.2nd%ile of total 24-hour SO_2 - The 99.2nd%ile of total 24-hour SO_2 is equal to the maximum of either (a) or (b) below:

(a) 99.2nd%ile of 24-hour mean background SO_2 + (2 x annual mean process contribution SO_2)
(b) 99.2nd%ile 24-hour mean process contribution SO_2 + (2 x annual mean background contribution SO_2)

99.7th%ile of total 1-hour SO_2 - The 99.7th%ile of total 1-hour SO_2 is equal to the maximum of either A or B below:

(a) 99.7th%ile hourly background SO_2 + (2 x annual mean process contribution SO_2)
(b) 99.7th%ile hourly process contribution SO_2 + (2 x annual mean background contribution SO_2)

Calculating the 24-hour mean SO_2 (99.2nd%ile) and the 1-hour mean SO_2 (99.7th%ile) PEC using the above two methods results in a maximum PEC based on method (a). This is presented in IE Application Attachment 7-1-3-2 report. Therefore, contour plots of the 24-hour mean SO_2 (99.2nd%ile) and the 1-hour mean SO_2 (99.7th%ile) PEC would be based on the annual mean rather than demonstrating the plume behaviour of the 24-hour mean SO_2 (99.2nd%ile) and the 1-hour mean SO_2 (99.7th%ile) process contributions. However, as outlined above the 1-Hour and 24-hour mean SO_2 process contribution plus 2 x annual mean background concentration are shown for reference in Figures 6 and 7.

The contour plots have been updated below in Figures 2 – 7 and Figure 9 – 10 to include added background concentrations to all contour plots.

Request 9:

9. HVO is listed in the application as a potential fuel. Update Attachment-7-1-3-2 Air Emissions Impact Assessment to reflect assessment of potential impacts when HVO is the fuel used.

Response to 9:

A review has been undertaken to consider whether nitrogen oxides (NO_X) emissions are lower when operating the backup generators using HVO when compared to operating the backup generators using conventional diesel. This study considers two types of generators commonly used by ADSIL. The Cummins C3000D5e is the most common generator in the ADSIL generator fleet whilst the CAT3516E is also commonly used.

HVO NO_X Pilot Test - Cummins

Cummins Power Systems have investigated the use of HVO in their C3000D5e (QSK78-G16) generators in order, *inter alia*, to determine their NO_X emissions in comparison to conventional diesel.

The study, undertaken in 2020 and 2021, compared the use of 100% HVO at 25%, 50%, 75% and 100% loads with the results for 100% diesel at the same loads for a range of emissions including NO_X. The results of this study, for NO_X, are shown below in Table 26:

Parameter	Units	HVO Run - 2021				HVO Run - 2020				Diesel Run - 2020			
	% Load	25%	50%	75%	100%	25%	50%	75%	100%	25%	50%	75%	100%
NO_X	mg/Nm^3	1569	1721	1912	2294	1737	1839	1964	2194	1744	1897	2048	2348

Table 26 Cummins C3000D5e HVO vs Diesel Test 2020 – 2021.

The results are summarised in Table 27 which shows that at every load HVO is approximately 2.3 – 4.1% lower in NO_X emissions, at loads between 50% and 100%, when compared to conventional diesel:

Parameter	Units	Maximum HVO Result (2020 - 2021)				Diesel Run - 2020				HVO NOX Concentration Compared To Diesel (%)			
NO_X	mg/Nm^3	1737	1839	1964	2294	1744	1897	2048	2348	99.6%	96.9%	95.9%	97.7%

Table 27 Percentage N_X Relative Difference Between Cummins C3000D5e HVO and Diesel - Testing In 2020 / 2021.

HVO NO_X Pilot Test - CATERPILLAR

CATERPILLAR have investigated the use of HVO in their CAT3516E 2400kW HPD generators in order, *inter alia*, to determine their NO_X emissions in comparison to conventional diesel.

The study, undertaken in May 2022, compared the use of 100% HVO at 250kW, 600kW, 1200Kw, 1800kW and 2400kW with the results for 100% diesel at the same power loading for a range of emissions including NO_X. The results of this study, for NO_X, are shown below in Figure 11:

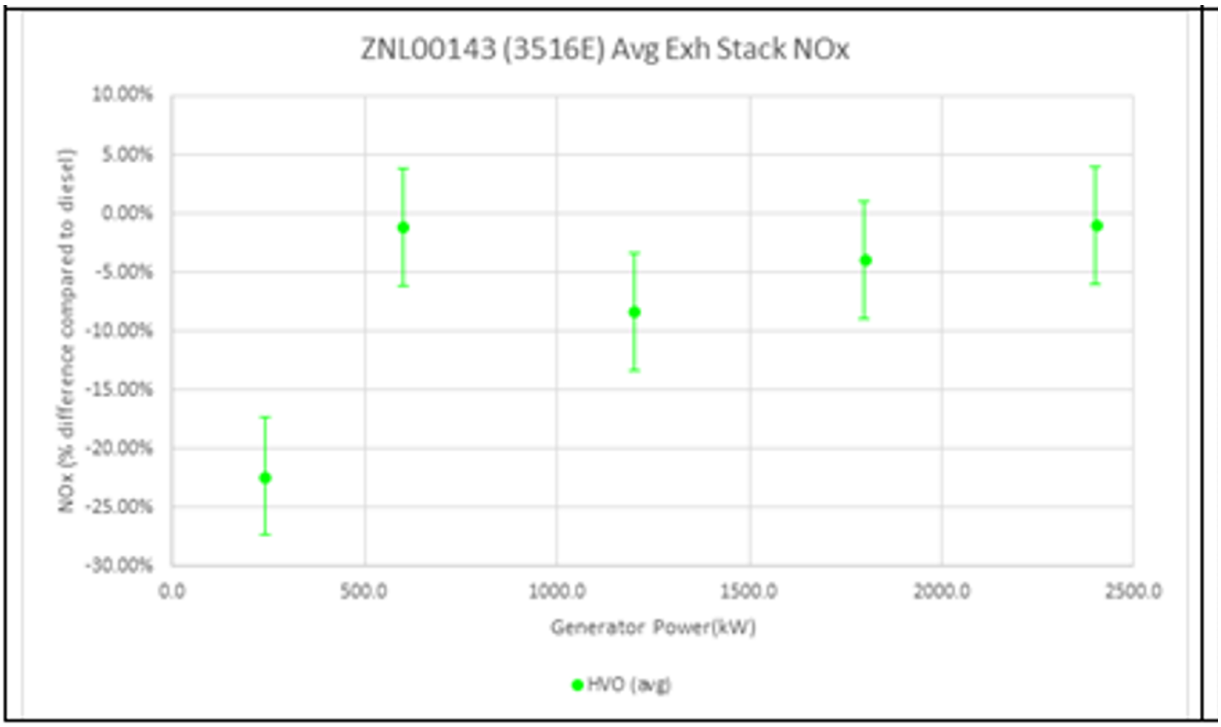


Figure 11 CAT3516E HVO NO_X Emissions Relative To Diesel – May 2022.

The results are summarised in Table 28 which shows that at each power loading HVO has lower NO_X emissions when compared to conventional diesel. The actual decrease varies with load and ranges from 1% - 22% depending on the power level.

Parameter	Units	Pilot Test May 2022				
Power	kW	250	600	1200	1800	2400
	% load	10%	25%	50%	75%	100%
NO_X	% Difference (HVO vs Diesel)	22%	1%	8%	4%	1%

Table 28 CAT 3516E HVO vs Diesel Test 2022.

NO_X Summary

In summary, based on pilot studies from both Cummins and CAT, the use of HVO will lead to lower levels of NO_X emissions when compared to conventional diesel. The actual decrease will depend on which generator is selected (Cummins C3000D5e or CAT3516E) and the load / power level at which the generator is operated with decreases ranging from 0.4% to 22% of the equivalent diesel emissions.

Diesel SO_2 and PM_{10} Emissions

Cummins Power Systems have investigated the SO_2 and PM in their C3000D5e (QSK78-G16) generators as shown below in Table 29 whilst CAT have investigated the PM in their 3516E generators as shown below in Table 30.

Exhaust Emissions Data @ 1500 RPM

	Standby Power			Prime Power			Continuous Power		
Component	g/BHP-h	mg/m^3	PPM	g/BHP-h	mg/m^3	PPM	g/BHP-h	mg/m^3	PPM
HC (Total Unburned Hydrocarbons)	0.12	50	81	0.14	59	96	0.19	81	130
NOx (Oxides of Nitrogen as NO_2)	4.9	2,091	1,019	4.6	1,935	943	4.2	1,787	871
CO (Carbon Monoxide)	0.62	263	210	0.52	218	175	0.29	123	98
PM (Particulate Matter)	0.06	23	N/A	0.05	19	N/A	0.04	15	N/A
SO_2 (Sulfer Dioxide)	0.11	38	16	0.11	39	16	0.11	40	16

Table 29 Cummins C3000D5e Datasheet Running On Diesel.

Emissions* (Nominal) - Full Load		
NOx mg/Nm³ (g/hp-h)	1777.1	(6.96)
CO mg/Nm³ (g/hp-h)	322.9	(1.27)
HC mg/Nm³ (g/hp-h)	16.8	(0.07)
PM mg/Nm³ (g/hp-h)	15.7	(0.07)
Emissions* (Potential Site Variation) - Full Lc		
NOx mg/Nm³ (g/hp-h)	1990.4	(7.80)
CO mg/Nm³ (g/hp-h)	581.2	(2.29)
HC mg/Nm³ (g/hp-h)	21.8	(0.09)
PM mg/Nm³ (g/hp-h)	22.0	(0.10)

**mg/Nm³ levels are corrected to 5% O_2. Contact your local Cat dealer for further information*

Table 30 CAT3516E Datasheet Running On Diesel.

HVO SO_2 Emissions

As shown in Table 31, the typical sulfur content of Ultra-low Sulfur Diesel (ULSD) is 13.8 ppm. The equivalent sulfur content of HVO is 5ppm. As the SO_2 emission concentration is directly related to the sulfur content of the fuel the associated SO_2 emission concentration from HVO will be even lower than diesel SO_2 and likely to be less than 15 mg/Nm^3 which is a factor of 130 less than the likely NO_X emission concentration.

		Ultra-Low Sulfur Diesel (ULSD)	Hydrotreated Vegetable Oil (HVO)
T90	°C	320	302
Density@15°C	g/mL	0.8492	0.7814*
Cetane Index, Calculated		44.7	69.8*
Sulfur	ppm	13.8	5.0
Viscosity @ 40°C	cSt	2.46	3.095*
Lubricity (maximum)	mm	0.45*	0.46*
Cloud Point	°C	-12*	-10*
Aromatics (by weight)	%	35*	1.1*
Flashpoint	°C	54*	55*

*values based on characteristics listed in the fuel certificate of analysis or in fuel specification; other values in the table represent results of fuels analysis conducted in Caterpillar Tech Center labs.
Note: Fuel specifications (e.g., ASTM D975 and EN 15940) indicate ranges or maximum/minimum for the various fuel characteristics

Table 31 Diesel And HVO Fuel Characteristics

HVO PM Emissions

As shown in Figure 12, CAT have studied the comparison between diesel and HVO smoke emissions[1]. Smoke emissions can be directly compared to PM emissions and thus higher smoke emissions will lead to higher PM emissions.

[1] https://www.cat.com/en_AU/by-industry/electric-power/Articles/White-papers/3000ekW-60hz-generator-set-diesel-hvo-test.html#multimedia-7rWSi0icEW1ZYxA-gallery

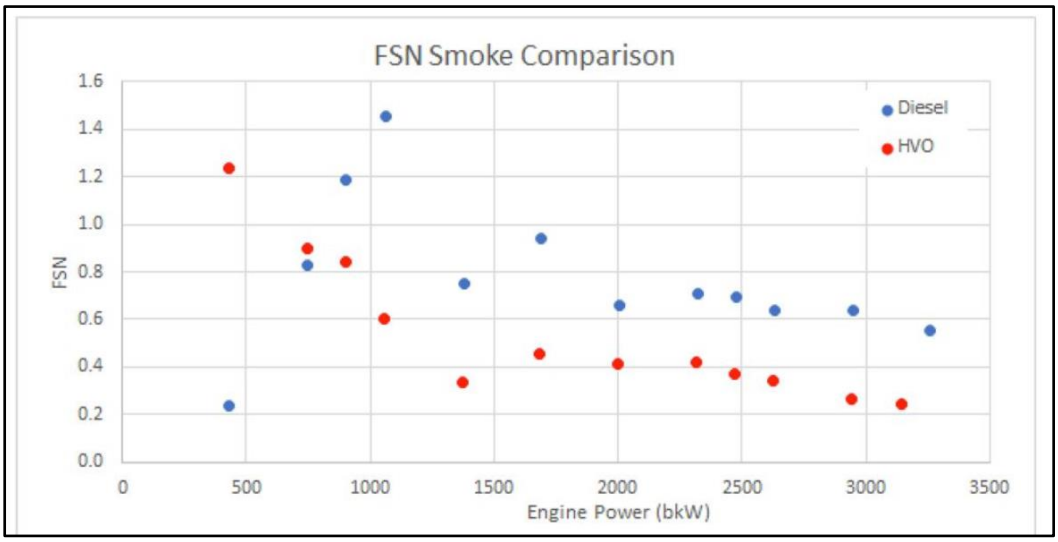


Figure 12 CAT 3516E 3,000 ekW – Smoke Emissions Diesel vs HVO

As shown in Figure 12, smoke (and PM) emissions from HVO are significantly lower than diesel particularly above 50% load.

Similarly, a study by MTU[2] (a Rolls-Royce company) found similar results based on PM emissions from diesel vs HVO as shown in Figure 13 for its MTU Series 4000 diesel generator:

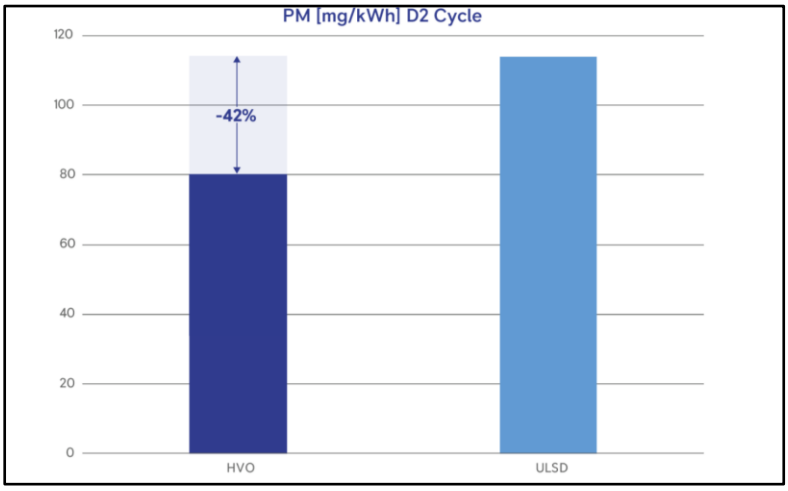


Figure 13 MTU Series 4000 Generator – PM Emissions Diesel vs HVO

As shown in Figure 13, PM emissions from HVO are significantly lower than diesel by approximately 42% over the test cycle.

9.7 SO_2 & PM Summary

In summary, based on studies from both CAT and MTU, the use of HVO will lead to lower levels of SO_2 and PM emissions when compared to conventional diesel. The actual decrease will depend on which generator is selected, fuel content of the diesel fuel and the load / power level at which the generator is operated with decreases of up to 42% of the equivalent diesel emissions.

[2] https://www.mtu-solutions.com/eu/en/technical-articles/2022/hvo-fuel-proven-to-be-effective-for-diesel-generator-sets.html

Request 2(c):

2. It is noted that all the backup generators associated with Building U and Building V, with the exception of the 1 no 2.19 MW_{th}, will use SCR.
    c. Provide an air impact assessment with regard to NH_3.

Response to 2(c):

NH_3 Air Impact Assessment

An EPA research study entitled "Ambient Atmospheric Ammonia in Ireland, 2013-2014"[7] has been used to inform background ammonia concentrations. A background value of 1 µg/m^3 has been added to the annual mean modelled process concentration for ammonia. A value of twice the annual mean background concentration has been added to the 1-hour modelled process concentration.

Building U has 11 no. back-up generator stacks which have a minimum height of 25m above ground level whilst Building V has 1 no. back-up generator stack which has a minimum height of 15.6m above ground level. The ammonia process emissions are outlined in Table 32.

Table 32. Summary of Ammonia Process Emission Information for Buildings U & V associated with the Facility

Stack Reference	Stack Height Above Ground Level (m)	Exit Diameter (m)	Cross-Sectional Area (m^2)	Temp (K)	Volume Flow (Nm^3/hr at 15% Ref. O_2)	Exit Velocity (m/sec actual)	NH_3	
							Concentration (mg/Nm^3 at 15% Ref. O_2)	Mass Emission (g/s)
Emergency Operation and Testing of Back-up Generators in Building U (100% load)	25.0 – Building U	0.3	0.07	738.2	19,557	120	11	0.0010 Note 1 / 0.060 Note 2
Testing of Generators (25% load) in Building U				655.2	8,300	49.8	11	0.025
Emergency Operation and Testing of Back-up Generator in Building V (100% load)	15.6 – Building V	0.4	0.13	790.2	9,126	33.4	11	0.00047 Note 1 / 0.028 Note 2
Testing of Generator (25% load) in Building V				639.2	4,032	13.3	11	0.012

Note 1 Reduced emission rates based on USEPA protocol (assuming 150 hours / annum) used to model emissions during emergency operation of generators (100% load)

Note 2 Maximum emission rates for generators (based on 100% load using diesel fuel) used for quarterly testing

The ammonia modelling results at the worst-case receptor (considers boundary, gridded and sensitive receptors) are detailed in Table 33. The results indicate that the ambient ground level concentrations are in compliance with the relevant air quality limits for ammonia. For the worst-case year, emissions from the site result in an ambient ammonia concentration (including background) which is 0.55% of the maximum ambient 1-hour limit value at the worst-case receptor (boundary receptor, location shown in Figure 14) and 0.62% of the annual limit value at the worst-

case receptor (boundary receptor, location shown in Figure 15). Concentrations are at most 1.11% of the 99th percentile 1-hour limit value at the worst-case receptor (boundary receptor location). The locations of the maximum concentrations for ammonia are close to the boundary of the site with concentrations decreasing with distance from the facility.

The geographical variations in ground level ammonia predicted environmental concentrations (PEC) beyond the facility boundary for the worst-case years modelled are illustrated as concentration contours in Figure 14 and Figure 15, to demonstrate the direction and extent of the emission plume.

Table 33. Normal Operations – Dispersion Model Results for Ammonia (NH_3)

Pollutant / Year	Averaging Period	Worst Case Receptor X,Y (UTM Zone 29 N)	Process Contribution (µg/m³)	Back-ground (µg/m³)	Predicted Environmental Concentration (µg/m³)	Limit Value (µg/m³) Note 1	PEC as a % of Limit Value
NH3 / 2018	Annual Mean	684992, 5920304	0.11	1	1.11	180	0.62%
	Maximum 1-Hour	685000, 5920350	11.66	2	13.66	2500	0.55%
	99th%ile of 1-Hour Means	684984, 5920305	1.32	2	3.32	300	1.11%
NH3 / 2019	Annual Mean	684992, 5920304	0.11	1	1.11	180	0.62%
	Maximum 1-Hour	685024, 5920314	10.89	2	12.89	2500	0.52%
	99th%ile of 1-Hour Means	685200, 5920250	0.55	2	2.55	300	0.85%
NH3 / 2020	Annual Mean	684992, 5920304	0.11	1	1.11	180	0.62%
	Maximum 1-Hour	684992, 5920304	9.9	2	11.9	2500	0.48%
	99th%ile of 1-Hour Means	684984, 5920305	0.99	2	2.99	300	1.00%
NH3 / 2021	Annual Mean	684992, 5920304	0.11	1	1.11	180	0.62%
	Maximum 1-Hour	684992, 5920304	10.89	2	12.89	2500	0.52%
	99th%ile of 1-Hour Means	685200, 5920200	0.44	2	2.44	300	0.81%
NH3 / 2022	Annual Mean	684992, 5920304	0.11	1	1.11	180	0.62%
	Maximum 1-Hour	685000, 5920350	12.1	2	14.1	2500	0.56%
	99th%ile of 1-Hour Means	684984, 5920305	0.77	2	2.77	300	0.92%

Note 1 *IPPC Environmental Assessment and Appraisal of BAT* (UK Environment Agency, 2003)

Note 2 Danish Environmental Guidelines, *Guidelines For Air Emission Regulation "C"* (2002)

The nitrogen deposition and acid deposition due to ammonia (and NO_X/NO_2 and SO_2) is outlined in the response to Questions 1(a) and 1(b) and Questions 2(a) and 2(b).

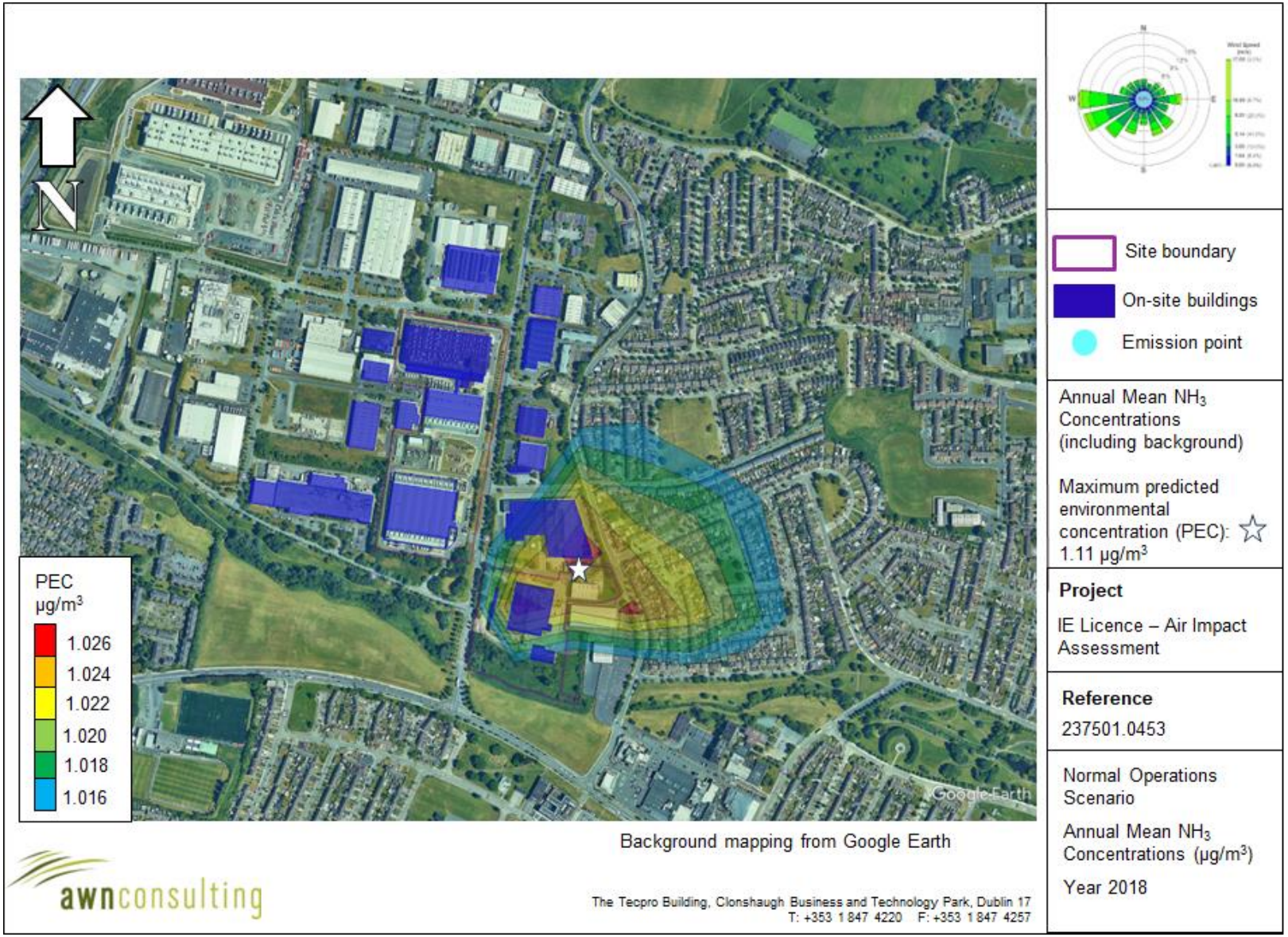


Figure 14 Maximum 1-Hour NH_3 Concentrations (µg/m^3) (including background concentrations)

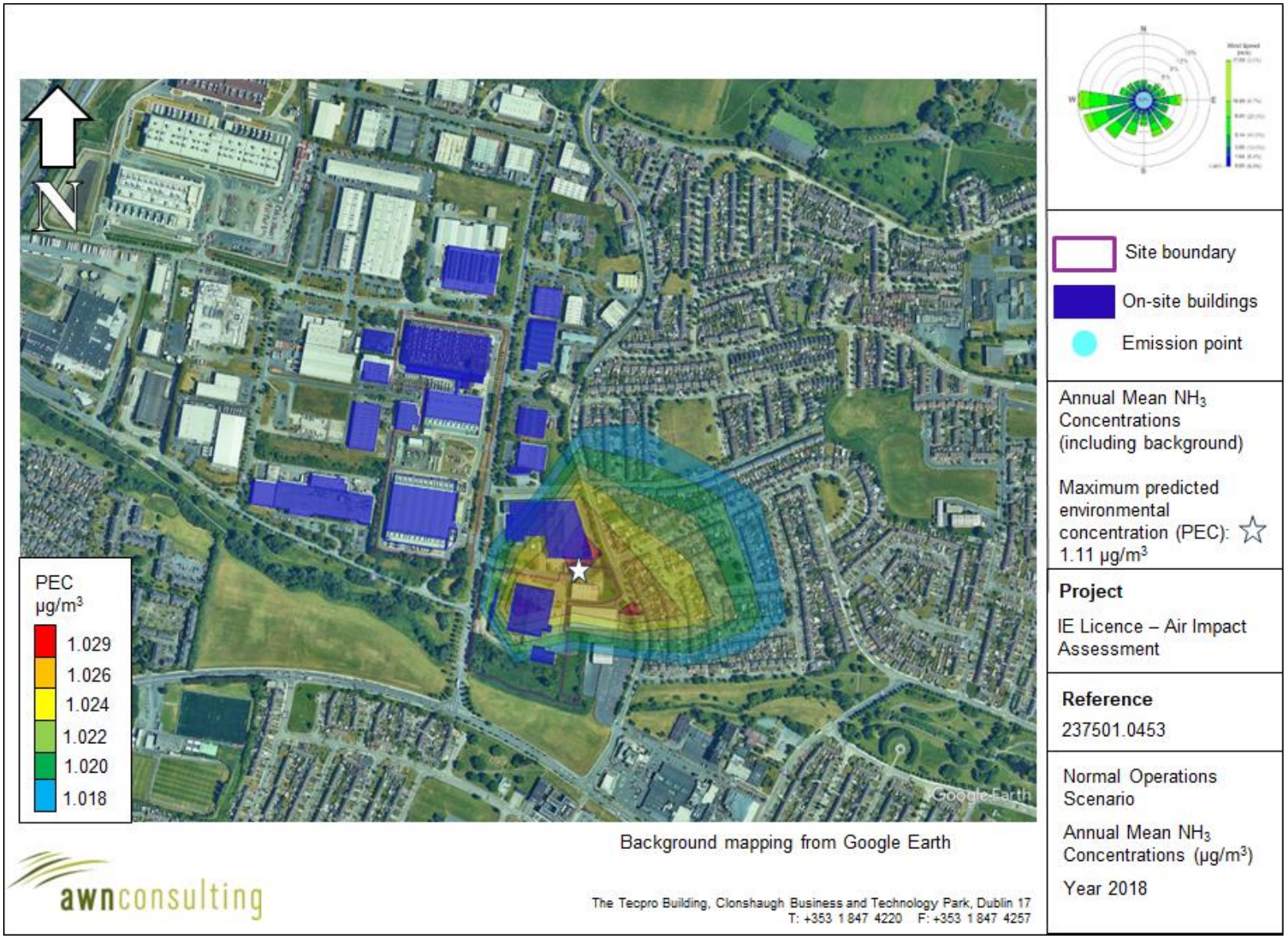


Figure 15 Annual Mean NH_3 Concentrations (µg/m^3) (including background concentrations)

Sincerely,

Dr. Edward Porter
Director (Air Quality & Climate)

References

(1) UK Environment Agency (2014) AGTAG06 – Technical Guidance On Detailed Modelling Approach For An Appropriate Assessment For Emissions To Air
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(6) EPA (2020) Air Dispersion Modelling from Industrial Installations Guidance Note (AG4)
(7) EPA (2016) Ambient Atmospheric Ammonia in Ireland, 2013-2014
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